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ACADEMIC MEDICINE

JOURNAL OF THE ASSOCIATION OF AMERICAN MEDICAL COLLEGES



Litigation Involving Residents: Part I

HMOs in Graduate Medical Education

The Academic Medical Center and Rural Health Policy

Training and Distribution of Appalachian Physicians

Studies on Effects of Sleep Deprivation and Fatigue

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Impacts of Decreased U.S. Training for FMGs

Predicting FMGs' Performances during Residencies

National Policy Perspectives

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SPECIAL ARTICLES

LELIA B. HELMS, J.D., Ph.D., and CHARLES M. HELMS, M.D., Ph.D.

Forty Years of Litigation Involving Residents and Their Training: I. General Programmatic Issues

Abstract—An analysis of reported state and federal adjudication from 1950 through 1989 was undertaken to identify issues and trends in litigation involving residents and their training. Of the 174 decisions cited, 38 (22%) involved disputes over general programmatic issues. The great majority of these addressed academic administration, especially issues arising from dismissals

of residents. During more recent periods, residency programs have accommodated to judicial scrutiny of dismissals and have prevailed more often than claimants in litigation. Successful accommodation by residency programs has apparently not operated as a disincentive to further litigation, however. *Acad. Med.* 66(1991):649-655.

In the published proceedings of a recent American Medical Association conference the courts were described as one of the "new regulators" of graduate medical education.¹ Potential areas of legal liability for graduate medical education were identified in the context of exploring the growing regulation of physician-training programs. The absence of systematic information about litigation involving residents and residency programs was described. This information vacuum hinders a clearer understanding of this area.

In this paper we review litigation reported over the past 40 years involving residents and residency programs. We apply a method used earlier to identify and classify litigation involving medical students and medical schools.^{2,3} By employing this analytic framework, we hoped to gain insight into the range and variety of issues in graduate medical education generating litigation, to discern trends in litigation with their policy implications, and to elicit a broader

understanding of similarities and differences in issues and problems facing educators administering undergraduate and graduate medical education programs.

Method

Employing the Westlaw computerized legal research service, we identified state and federal cases involving interns, residents, fellows, or programs of graduate medical education for the 40-year period 1950-1989. The two topical indexes employed to search the Westlaw database were Hospitals and Colleges, and Universities. The key words employed were intern, resident, fellow, graduate medical education, postgraduate medical education, and residency training program.

Within the legal system only reported litigation may serve as precedent for resolving disputes. The cases identified by this survey are those to which courts refer for guidance in making decisions. However, there are several limitations inherent in this research method. First, only reported court decisions are included. The actual number of cases filed, withdrawn, settled, or decided by a trial court cannot be accurately determined, since present judicial information systems do not collect such information either comprehensively or systematically. Data from one state indi-

cate that as few as 1% of cases filed with a court reach the appellate level, where a written decision might be included in the legal reporting system.^{4,5} Clearly, reported court decisions constitute only the tip of the iceberg of litigation. Second, differential reporting by the legal reporting system introduces bias. State court reporting systems generally include only appellate-level decisions. The federal reporting system captures many appellate decisions as well as some district (trial) court decisions. Thus, a selective bias towards appellate-level decisions is expected. Despite these limitations, an overview of reported decisions should be helpful in discerning the issues litigated in graduate medical education and general patterns of litigation.

Results and Analysis

Reported litigation has undergone substantial changes in volume as well as in a broadening of issues litigated over the 40-year study period.

Volume of Litigation

A chronological summary of reported litigation involving residents and issues of graduate medical education during the 40-year study period can be found in Table 1. From 1950 through 1989, 174 cases were reported. Of these, 36 (21%) were de-

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Table 1
Litigation Involving Residents

Period	State Court		Federal Court		Total
	General	Malpractice	General	Malpractice	
1950-1954	—	4	—	1	5
1955-1959	—	8	—	1	9
1960-1964	—	8	—	—	8
1965-1969	—	7	—	3	10
1970-1974	3	5	1	4	13
1975-1979	3	21	4	2	30
1980-1984	3	26	4	4	37
1985-1989	13	37	7	5	62
Total	22	116	16	20	174

cided in federal courts and 138 (79%) in state courts. Of the reported federal cases, 24 (67%) were decisions at the district court level, 12 (33%) were decisions at the circuit (appellate) level, and none was decided by the United States Supreme Court. The number of reported cases has grown dramatically, from 13 cases in 1970-1974 to 62 cases in 1985-1989, nearly a fivefold increase. The growth has occurred primarily in state court cases. Medical malpractice suits were the great majority (78%) of cases reported; this distinct body of litigation is discussed in a separate paper.⁶

In this paper we focus on the 38 state and federal cases (22%) related to programmatic issues, identified by year under "General" in Table 1. These cases litigate issues involving the organization, administration, and support of graduate medical education programs. Interestingly, all 38 general cases identified in this survey were decided after 1970, the year when the number of active applicants

for National Residency Matching Program residency positions began to rise dramatically from a "baseline" of approximately 9,000 to its current level of approximately 19,000.^{7,8} Twenty cases (53%) were decided after 1985, indicating a sharp growth in recent litigation in this area.

Issues of Litigation

Table 2 provides information about specific issues giving rise to litigation over the study period. Thirty-one cases related to academic administration accounted for the great majority (82%) of programmatic litigation. These cases increased in number consistently and dramatically over the last 20 years of the study period, from one in 1970-1974 to 18 in 1985-1989. The seven remaining cases litigated issues of collective bargaining, taxation or reimbursement, and wrongful interference with contractual relations.

Dismissals. Suits involving dis-

missal of residents from training programs were the majority (58%) of the 31 cases related to academic administration. Of the 18 dismissal cases, 11 were litigated in 1985-1989, a period that witnessed striking growth in litigation related to the financing of undergraduate medical education.³ This recent increase in dismissal litigation by residents may have been driven, in part, by the same economic forces. That is, residents with substantial indebtedness related to undergraduate medical education expenses and threatened with loss or reduction in present and future income may be increasingly willing to challenge dismissals by graduate training programs.

Ten dismissal cases litigated whether due process is required in dismissal and the nature of that process. Before 1983 due process was the only issue litigated in dismissals. Since then, however, issues of sovereign immunity, defamation, contract, relationship to procedures set forth in a collective bargaining agreement, and discrimination have also been addressed within the context of dismissal. Among the 18 dismissal cases, three cases alleged discrimination based on sex, and one alleged discrimination based on national origin.⁹ All four discrimination cases were reported since 1985. This may point to a pattern, similar to that reported for undergraduate medical education, of a broadening of the issues raised by plaintiffs' attorneys to include decisions made before or ancillary to the final stage of dismissal.²

Admission. In contrast to dismissal cases, only two admission cases were

Table 2
Issues Giving Rise to Litigation

	1970-1974		1975-1979		1980-1984		1985-1989		Total
	Federal	State	Federal	State	Federal	State	Federal	State	
Academic administration	—	1	3	2	4	3	6	12	31
Collective bargaining	—	1	1	—	—	—	—	1	3
Tax/finance	1	1	—	—	—	—	1	—	3
Other	—	—	—	1	—	—	—	—	1
Subtotal	1	3	4	3	4	3	7	13	38
Total		4		7		7		20	38

identified: one alleging discrimination based on handicap and a second challenging limits upon admission of osteopathic physicians to a cardiovascular fellowship program.¹⁰ The paucity of suits related to admission relative to dismissals may be explained in part by the large number of residency positions available nationally and the highly structured and confidential nature of the selection mechanisms employed by the National Residency Matching Program. These forces may enhance the likelihood of medical students' achieving an acceptable position.

Government monitoring and regulation. Seven cases related to academic administration dealt primarily with the appropriate role of government in monitoring or regulating programs of graduate medical education. Two decisions addressed challenges to terminations of residency programs by the Veterans Administration.¹¹ One case addressed the power of the state medical board to set requirements for the supervision of residents,¹² while another challenged state-set salary rates.¹³ A fifth case, brought by residents, sought to rescind a long-standing contract between the County of Los Angeles and the University of Southern California for the employment of residents in a county health care facility by applying county requirements regarding cost-effectiveness.¹⁴ A sixth challenged a state's application of changes in licensing requirements for residents on an *ex post facto* basis.¹⁵ The last dealt with a suit brought by a New York labor organization representing residents, interns, and fellows questioning regulations limiting the number of hours and establishing minimum operating standards for hospitals.¹⁶

ACGME accreditation. Two cases under academic administration involved challenges by training programs to withdrawal of their accreditation by the Accreditation Council for Graduate Medical Education (ACGME). In one, a hospital with a religious affiliation alleged that the withdrawal of accreditation from their program in obstetrics and gynecology was impermissibly based upon

Table 3
Prevailing Party in Litigation

Issue	Resident	Other Party	Unclear/Mixed	Total
Academic administration	7	20	4	31
Collective bargaining	1	2	—	3
Tax/finance	1	2	—	3
Other			1	1
Total	9	24	5	38

the hospital's religious opposition to sterilization and abortion.¹⁷ In the second, a medical center challenged the authority of the ACGME, an unincorporated association, to withdraw accreditation from its surgical residency program.¹⁸

Safety of residents. The final two cases involving academic administration arose from the same set of operative facts and focused on the same legal objective, establishing the responsibilities of residency training programs to provide for the safety and protection of residents. One suit approached this through arguments grounded in federal law, while a second argued negligence by program administrators under state law.¹⁹

Collective bargaining. Three cases litigated issues of collective bargaining directly. The only federal case arose under the jurisdiction of the National Labor Relations Board and decided the question of whether residents were hospital employees able to organize a union.²⁰ Cases involving residents in public hospitals are governed by state laws that regulate the rights of state employees to organize and bargain collectively over the terms and conditions of their employment. California and Michigan have faced litigation by residents over issues directly related to collective bargaining.²¹ In several of the previously cited academic administration cases, collective bargaining was indirectly involved through a labor organization representing residents or through interpretation of a provision of a collective bargaining agreement in the context of a dismissal.^{12,14,16,22}

Taxation or reimbursement. Three cases addressed problems of taxation or reimbursement. Federal courts re-

solved two: whether the compensation paid to residents was taxable salary or an educational scholarship²³; and whether Medicare regulations provided for appropriate reimbursement for outpatient care by residents.²⁴ A state court decided the third: whether a community could levy property taxes on houses supplied to residents by their employer, a local hospital.²⁵

Wrongful interference. Finally, a case classified as "other" arose when a supervising physician brought a claim against a resident for wrongful interference with contractual relations.²⁶ The physician argued that testimony provided by the resident to the hospital's peer review committee caused the eventual removal of his staff privileges. This case was categorized separately, since it involved a personal claim by one physician against another, the resident. Although it did not directly address programmatic issues, it clearly has implications for relationships between faculty and housestaff.

Outcome of Litigation

Most of the 38 cases may be categorized by outcome, i.e., the winning party (Table 3). Residents have prevailed in only nine (24%) of the cases. The party opposing the resident has won in 24 (63%) of the cases. In five (13%) of the cases, a winner could not be determined, either because the issue was narrowly procedural or because a remand was required to retry disputed facts. Residents prevailed in only seven (23%) of the 31 cases related to academic administration.

Dismissals. Of the 18 challenges to the dismissal of a resident, the pro-

gram's decision was overturned in only four (22%) of the cases, while the outcome was unclear or mixed in two (11%) of the cases.^{27,28} This already small proportion of successful challenges to dismissal by residents may be decreasing over time: in 1970-1979, residents prevailed in three of five suits, whereas in 1980-1989 a resident prevailed in only one of 13 suits. Early successes enjoyed by residents addressed issues of due process and procedural protection in dismissals and outlined minimal requirements for programs in dismissal of residents.²⁷ Since these decisions, residents have prevailed less frequently. Two cases, both alleging procedural violations, had mixed outcomes.²⁸ In one case of dismissal, sex discrimination was confirmed.²⁹ In three other cases alleging discrimination, none was found.³⁰

Admission. In cases litigating admission, outcomes were mixed. One resident prevailed in an allegation of handicap discrimination, but another lost a challenge to the legitimacy of requiring allopathic rather than osteopathic training.⁷

Government monitoring and regulations. The courts have generally sustained the exercise of regulatory authority by government over programs of graduate medical education. A challenge to a state medical board's regulation that established standards for supervision of residents performing surgery failed.¹² The terms of a contract between a residency program and the county to provide care to county health care facilities were interpreted to sustain the county's position.¹⁴ An attempt to limit the authority of the Commissioner of Health in New York was rejected as the court approved regulations limiting the hours worked by residents.¹⁶ In one case residents did succeed in challenging the retroactive application of state licensing requirements for graduates of foreign medical schools, which excluded such graduates from receiving temporary certificates of registration after being accepted into training programs.¹⁵ In another case, the outcome of litigation by a program challenging resi-

dents' salaries set by a state board was unclear. At issue was the question of how to compute the average number of hours worked weekly by residents.¹³

ACGME accreditation. In two cases challenging withdrawal of accreditation, courts sustained the ACGME in one, but required additional litigation in the second. In the first case a New York court upheld a determination that a medical center had not complied with the general academic requirements for a surgery residency program as set forth by the ACGME and evaluated by its Residency Review Committee. The ACGME was found to have acted reasonably and provided sufficient due process in its procedures for evaluation and appeal.¹⁸ In the second, a federal court granted to a Baltimore hospital a preliminary injunction forbidding withdrawal of accreditation from its program in obstetrics and gynecology. The court reasoned that the withdrawal constituted "state action" for which a hospital could sustain a civil rights action against ACGME alleging that the termination was based on religious discrimination. For purposes of this review, this case was classified as an unclear outcome. In 1990, however, a decision not within the time frame for inclusion in this study, a federal court resolved the substantive issues raised by this case and sustained the ACGME's withdrawal of accreditation. The court found that the ACGME did not violate the free exercise of religion clause of the Constitution by refusing to exempt a Roman Catholic hospital from the requirement of teaching family planning procedures in its residency training program.¹⁷

Safety of residents. Efforts to establish the liability of a training program for an alleged failure to provide for the safety of a resident murdered while providing care to a patient in an emergency room were rejected in both state and federal courts.¹⁹ The estate of the deceased resident was unsuccessful in claiming that federal civil rights statutes were violated and that the program was negligent under the state's tort claim statute.

The limited numbers and diversity as well as the mixed outcomes in cases included in collective bargaining, tax/finance, and other categories limit the significance of conclusions that may be drawn from these outcome data.

Collective bargaining. The right of residents to organize and bargain collectively in public hospitals was sustained under the state law in California in 1986, but denied under Michigan law in 1972.²¹ Residents working in private hospitals, covered by federal rather than state law, failed in their claim that the National Labor Relations Board should extend its jurisdiction to cover their proposed union and permit collective bargaining. In that case, the National Labor Relations Board classified residents as employees, but found that they were excluded under the National Labor Relations Act.²⁰

Taxation or reimbursement. The University of Cincinnati succeeded in its challenge to the manner in which Medicare calculated compensation for care provided by residents.²⁴ However, residents' salaries were held to be taxable income, not educational scholarships, while a hospital was required to pay property tax on housing supplied to residents.^{23,25}

Wrongful interference. Finally, in a case with implications for relations between residents and staff, a court in remanding for retrial found that testimony given by a resident to a peer review committee deliberating whether to revoke a physician's staff privileges was not entitled to an absolute privilege from disclosure in a suit for wrongful interference with contractual relations. It was determined that if any motivation to "get even" could be attributed to the resident in providing such testimony, then any privilege would disappear.²⁶

Discussion

Reported litigation involving residents and programs of graduate medical education increased substantially over the past 40 years, largely related to malpractice suits. However, growth in reported litigation in general pro-

grammatic areas has occurred as well in the past five years, especially over the issue of dismissal.

In 1978, the Supreme Court in *Horowitz* addressed the issue of dismissal procedures for medical students. The Court found that informal procedures were sufficient in student dismissal proceedings and deferred to evaluations by faculty in matters of academic judgment.³¹ Since *Horowitz*, suits involving residents' dismissals have been treated similarly. Courts have rather consistently sustained the rights and responsibilities of faculty to evaluate and to dismiss a resident based on academic performance.

A recurrent question in dismissal cases, however, has been whether residents should be classified as employees rather than students. If classified as contractual employees, residents could require greater procedural protections. In the three early dismissal cases in which residents prevailed, the residents' status as employees or students was never clearly resolved, whereas in the 15 cases reported since 1980, lower level courts have usually classified residents as students.

Nevertheless, some ambiguity persists. As recently as 1988, the Federal Fifth Circuit Court sustained dismissal of a dental resident under minimal academic procedures but found no compensable damage because the program "bought out" the time remaining in a dental resident's contract of employment.³² Similarly, when a program failed to comply with a 30-day notice-of-termination procedure in a resident's contract, the court required an additional 30 days of compensation.³³ Experience to date suggests, therefore, that academic procedures may be used to dismiss a resident, but that contract law prevails in dealing with his or her compensation.

Economic incentives created by the burden of growing debt of doctors-in-training may operate to motivate residents to litigate when dismissal will foreclose or delay opportunities for debt repayment. In at least one case identified in this study, the plaintiff, while contesting his dismissal from

the third year of residency training, was simultaneously involved in bankruptcy proceedings.³³ The number of challenges to residency dismissal decisions has shown recent signs of growth. This has occurred despite the fact that the courts have more often than not sustained actions by training programs as meeting judicial standards. The success of training programs does not appear to have operated as a disincentive to further litigation.

Whether, as they have begun to do in medical student dismissal cases, plaintiffs' attorneys will ask courts to look beyond due process in dismissal procedures and to look more closely at the decision making leading to the final step of dismissal is unclear at this point.² There is preliminary evidence that a pattern of diversification of litigated issues may be unfolding in resident dismissal suits. Four cases of discrimination that have focused on issues of bias in decision making have been litigated during the last five years.⁹ One of these alleged the discrimination to have occurred during faculty evaluation of performance, not in the dismissal proceeding, and suggested that requirements of due process be applied to faculty evaluation.³⁴ Another case not claiming discrimination argued that decisions about dismissal should be preempted by the grievance procedures in a collective bargaining agreement, when there is one, rather than being left to the faculty or program administration.²² Neither claim was sustained by the courts.

Residency programs are exposed to litigation from sources other than their own trainees. These liabilities are illustrated by several cases identified in this study. The rights of residents to organize and bargain collectively by law in several states expose programs operated by public hospitals to a broad range of legal issues. To date, nongovernmental (private) hospitals or those hospitals owned by a municipality but operated by a private contractor have not been subject to the complex requirements of collective bargaining and the associated potential for litigation.²⁰ When avail-

able as an option, union membership may provide residents with economic and legal resources necessary to engage in and sustain litigation. Unions have challenged state regulations on hours (as too onerous), as well as training agreements for the provision of service in a variety of institutions.^{14,16} Additionally, procedures established by collective bargaining agreements may be interpreted as being incorporated into the dismissal procedures for residents.²² Certainly, the debt burden of residents described earlier gives residents and residents' organizations every incentive to fight adverse decisions about dismissals and to expand their role in assuring favorable policies affecting the terms and conditions of their employment.^{16,33}

The potential for divisiveness between residents and staff physicians arising over the issue of peer review is illustrated by one case identified in this survey.²⁶ While encouraging the professional review of standards of practice is the objective of peer review legislation, there may be unintended effects upon physicians in training if they become involved in such proceedings. Residents must understand the risks of liability, particularly in states where confidentiality and immunity issues have not been thoroughly litigated.

Regulations by state agencies responsible for providing and monitoring health care have provoked a growing number of challenges by residency programs and organizations. When contesting state regulatory requirements in this area, programs have enjoyed little success in the few cases identified in this survey. Although programs retain some discretion to determine qualifications for admission, the state's regulatory authority has been sustained in arguments that limit the number of hours worked by residents, that set rules for reimbursement, and that establish standards of supervision.^{12,13,16} The courts have viewed state government intervention at these levels as a legitimate exercise of regulatory authority under existing statutes. Only the retroactive denial of certificates of

registration by a state exercising its authority to upgrade minimum qualifications for medical practice was found to have substantially prejudiced the rights of residents to participate in residency programs.¹⁵

Finally, the role of the ACGME has been the focus of recent litigation when hospital training programs have failed to meet the criteria for accreditation. In two cases where the ACGME withdrew accreditation, both the procedures relied upon in making decisions about accreditation and the substance of the decisions made by the Residency Review Committee were sustained by the court. In one, the court deferred to the academic expertise of the ACGME both to set standards for and to evaluate programs of professional medical education.¹⁶ In the second decision, the action of a private, nongovernmental organization, ACGME, in withdrawing accreditation was found to constitute state action although later sustained as within both the First and Fourteenth Amendments.¹⁷ The finding that ACGME acts as an arm of the state in making decisions on program accreditation raises concerns for both attorneys and medical educators. However, both decisions established a precedent that may be viewed as one of support for the leadership role of the ACGME in graduate medical education and its relationship to state agencies that register training programs. Nonetheless, these suits illustrate the complexity of the legal environment within which graduate medical education functions.

That graduate medical education faces pressures from a growing number of sources interested in fiscal and regulatory reform is not news. While substantial progress has been made in understanding the environmental factors conducive to the regulation of physician training programs, no data have been systematically compiled to assist in understanding the impact of the judiciary upon the education of residents.¹ It is clear from the present study that the courts have become involved with growing frequency in disputes arising from the administration of programs of graduate medical edu-

cation. Indeed, viewing their role as a "new regulator" of such programs is not unreasonable if broadly construed.¹ However, closer examination of litigation reveals that courts in most instances serve primarily to confirm rather than to initiate policies made by other participants making decisions affecting graduate medical education. Only in the area of dismissals of residents have courts elected to wrestle with substantive issues of educational decision making. In these cases, after requiring some procedural protections for residents in the mid 1970s, the courts have rather consistently sustained the faculty's authority in dismissal, primarily by consistently viewing residents as students rather than employees. In other areas, however, the courts perform their traditional function of statutory interpretation. In this role, courts, more often than not, serve to sustain government policy and actions rather than to overturn them. On occasion, however, the courts provide a forum for programs to challenge and rectify perceived mistakes. As the magnitude of regulatory reform in health care and the costs of undergraduate and graduate medical education increase, so will the frequency of challenges by both residents and training programs through the courts. Thus, in addition to serving the more familiar role of monitoring programs for compliance with standards of due process and fairness, the courts will also provide access to policymakers when traditional channels fail.

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Involvement of Health Maintenance Organizations in Graduate Medical Education

Abstract—Prepaid health care plans are likely to play an important part in the current transition from inpatient to ambulatory care training of physicians, because such plans enroll one in seven Americans. In the spring of 1990, the Group Health Association of America conducted a survey of health maintenance organizations (HMOs) to assess their level of involvement in graduate medical education (GME). A questionnaire was sent to the 481 HMOs in the United States that had been operational for at least four years; 58% responded. Fifteen percent (42 HMOs) indicated that they were directly involved in GME. The

majority of these 42 indicated that they had an agreement with an academic medical center (AMC) or a teaching hospital to serve as an ambulatory care rotation site. About one-sixth of the 42 HMOs had been approved by the Accreditation Council for Graduate Medical Education to serve as a sponsoring organization. HMOs directly involved in GME were more likely to be staff model and group model HMOs; older plans with an enrollment of 50,000 or more; not-for-profit plans; and those owned or sponsored by an AMC. *Acad. Med.* 66(1991):656-661.

There is a growing consensus that current residency programs place too much emphasis on acute, inpatient care, failing to recognize that the majority of services are provided in ambulatory care settings.² In recent years, numerous leaders in the field of graduate medical education (GME) have observed that for all the early attention paid to comprehensive medical care, there is a noticeable absence of well-developed educational programs that function in ambulatory care environments.³⁻⁵ And the emphasis on training more primary care physicians has had only a minor impact on the dominant pattern of inpatient-based medical education.⁴

Recent changes in hospitals' case mix, stemming from cost-containment pressures, have diminished the "educational value" of inpatients.⁶ The inpatient setting no longer affords residents adequate exposure to certain types of conditions (e.g., cataracts, inguinal hernia) and procedures (e.g., laser and arthroscopic surgery) that are for the most part managed on an outpatient basis; shorter lengths of hospital stay reduce opportunities for residents to learn about the progression of disease and treatment modalities;

and increased severity of illness of hospitalized patients affords fewer opportunities for residents to provide preventive, rehabilitative, chronic, and terminal care.⁶

Health maintenance organizations (HMOs) will likely play an integral role in future efforts to place greater emphasis on training in ambulatory settings, because HMOs constitute a growing share of the health care marketplace. In 1970, there were only 37 HMOs in the United States.⁷ At the end of 1989, there were 591 HMOs enrolling 34.7 million people, approximately one in seven Americans.¹

It is increasingly important that methods be found to involve HMOs in GME, not only because HMOs have increased in market share, but also because HMOs represent a distinct type of health care financing and delivery system. Medical practice within an HMO differs from most traditional fee-for-service environments. To be effective and satisfied, physicians must learn a new set of skills, namely those required to function within a complex organization(s) that demands both clinical and financial accountability from its providers within an environment of active peer review.

Some HMOs have been involved in GME for many years. Indeed, during the 1970s, it appeared that an HMO might become an integral part of most academic medical centers (AMCs). A survey conducted in 1973 indicated that 15 medical schools had formal affiliations with HMOs and 42

were in the planning or feasibility stage for the development of an HMO or affiliation with an existing HMO.⁸ A handful of AMCs started their own HMOs, including George Washington University, Georgetown University, and Washington University.⁹⁻¹¹ Many other AMCs developed formal affiliation agreements with existing HMOs that provided for varying levels of AMC involvement in HMO governance and management; examples include Rutgers Medical School (now Robert Wood Johnson Medical School) and Rutgers Community Health Plan, and Harvard Medical School and Harvard Community Health Plan.^{12,13}

In establishing collaborative GME arrangements, the objectives of AMCs and HMOs are quite different, and not entirely complementary. An AMC's objectives relate primarily to its mission as a teaching institution, and include finding an appropriate patient mix for teaching purposes; exposing students to clinical settings that emphasize prevention and primary care and the efficient delivery of services; enhancing manpower and resources to support education; and exposing students to generalist physicians as role models.¹⁴ An HMO's objectives relate to its primary mission of providing appropriate and affordable patient care through (1) the recruitment and retention of adequate numbers of physicians and of physicians experienced in prepaid, organized delivery systems; and (2) the enhancement of the HMO's public

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image as a quality organization.¹⁴ AMC's assume that affiliation with an HMO will bring increased use of the university hospital and subspecialists; but such arrangements have been financially devastating for some HMOs, because their viability necessitates judicious use of services through the careful selection and monitoring of providers.^{10,11} Inherent differences between AMC physicians, who are primarily subspecialists and research-oriented, and HMO physicians, who are more likely to be primary care physicians and practice-oriented, have also led to conflicts concerning faculty appointments, promotions, remuneration, and responsibilities.¹⁰

For these and other reasons, it has become increasingly apparent that very close relationships between AMC's and HMOs may be untenable. Of the six HMOs founded by AMC's during the late 1960s, only two survive in their original forms and are actively involved in teaching.¹⁴ It is clear that if HMOs are to play a major role in GME, it will be necessary to identify "models" for affiliation or involvement that recognize and balance the differing objectives and constraints of AMC's and/or major teaching hospitals and HMOs.

As a first step in this process of identifying models for HMO involvement in GME, the authors under the auspices of the Medical Directors Division of the Group Health Association of America (the largest and oldest trade association representing HMOs) conducted a survey to ascertain the extent to which HMOs are currently involved in GME; the characteristics of those HMOs most likely to be involved in GME; the kinds of relationships that have developed between HMOs and AMC's and/or teaching hospitals; and the volume of residents receiving training in HMOs by specialty and postgraduate year.

Method

The survey questionnaire was sent to 481 of the 591 prepaid health plans in the United States that have been operational since 1986. Plans less than

four years old were excluded because it was felt it would be unrealistic to expect very young plans to be involved in GME. Questionnaires, which were addressed to the plans' medical directors, were first sent in May 1990, and a second request was sent in July 1990. Of the 481 plans that received the questionnaire, 281, or 58%, responded.

Approximately half of the responding plans had enrollments of 50,000 or more, and over 45% of the responding plans were eight years old or older. Of the 281 respondents, 48 (17%) were staff models, 43 (15%) were group models, 48 (17%) were networks, and 142 (51%) were independent practice associations (IPAs). (Group model HMOs are organized, prepaid health care systems that contract with one independent group practice to provide health care services; staff model systems deliver health care services through a salaried group that is employed by the HMO; network model plans contract with two or more independent group practices; and IPAs contract directly with physicians in independent practice, with one or more associations of physicians in independent practice, and/or with one or more multispecialty group practices, although the plan is predominantly organized around single solo-specialty practices.)¹⁵

In type of plan, the respondents were reasonably representative of the sample as a whole. The response rate was somewhat higher for group (77%) and network (70%) models of HMOs than for staff (57%) and IPA (52%) models. Response rates were also higher for larger plans with enrollments of 50,000 or more; for more mature plans, especially those in the eight-to-15-year age group; and for not-for-profit plans.

Compared with the industry as a whole, the survey respondents may somewhat overstate GME involvement. As is discussed soon, some of these characteristics associated with higher response rates are also characteristics associated with a greater likelihood of a plan's being involved in GME.

Results

The questionnaire requested information about direct and indirect involvement in GME. Plans with direct involvement fall into one of two categories:

- The HMO (or a hospital owned or operated by the HMO) has been approved by the Accreditation Council for Graduate Medical Education (ACGME) to serve as a sponsoring organization of a graduate medical education program.
- The HMO (or a group practice with which it contracts) has a formal agreement with an AMC or teaching hospital to serve as an ambulatory care rotation site.

The results indicated that indirect involvement in GME took many forms, including (1) HMO physicians' involvement in teaching residents at AMC's or teaching hospitals, either on the HMO's time or their own time; and (2) the HMO's being a part of a larger health system that is formally involved in GME.

Fifteen percent of the respondents (42 HMOs) were directly involved in graduate medical education. Seven respondents (2%) indicated that their HMO (or a hospital owned or operated by their HMO) had been approved by the ACGME to serve as a sponsoring organization of a GME program. Thirty-eight (14%) said that their HMO had an agreement to serve as an ambulatory care rotation site with an AMC or teaching hospital that was not owned or operated by the HMO. Three respondents indicated that their HMO had both arrangements.

Table 1 provides descriptive information about the 42 HMOs that in 1990 were directly involved in GME. Staff model and group model HMOs were far more likely to have direct, formal GME arrangements than were network or IPA models. Thirty-three percent of the staff models and 37% of the group models responding to the survey had a formal GME arrangement, compared with 8% of the network models and 4% of the IPA

Table 1
Distinguishing Characteristics of 42 Health Maintenance Organizations (HMOs) Directly Involved in Graduate Medical Education (GME) in 1990*

Characteristic	HMOs Directly Involved in GME (n = 42)			Respondents (n = 281)
	No. of HMOs	% of Respondents	% of Respondents Involved in GME	
Model type				
Staff	16	33	38	48
Group	16	37	38	43
Network	4	8	10	48
IPA	6	4	14	142
Total	42	15	100	281
Enrollment				
0-19,999	8	14	19	56
20,000-49,999	7	8	17	86
50,000-99,999	12	20	29	61
100,000 or more	15	19	36	78
Total	42	15	101†	281
Plan age				
4-7 years	12	8	29	152
8-15 years	13	15	31	89
16 years or more	17	43	40	40
Total	42	15	100	281
Location (region)				
New England	3	15	7	20
Mid-Atlantic	6	15	14	40
South Atlantic	5	12	12	43
East Central	9	15	21	60
West Central	3	7	7	44
Mountain/Pacific	16	22	38	74
Total	42	15	99†	281
Tax status				
For-profit	10	6	24	167
Not-for-profit	32	28	76	114
Total	42	15	100	281
Owned or sponsored by an academic medical center				
Yes	7	35	17	20
No	35	13	83	261
Total	42	15	100	281

*To ascertain the extent to which HMOs are involved in graduate medical education (GME), the authors surveyed the 481 prepaid health plans in the United States that had been in operation four years or more; 281 responded. This table compares characteristics of plans with direct involvement in GME with characteristics of all the respondents.

†Does not equal 100% because of rounding.

models. A greater proportion of large plans with enrollments of 50,000 or more were directly involved in GME than were smaller plans. The likelihood of involvement also increased with plan age. Twenty-eight percent

of the not-for-profit plans were directly involved in GME, compared with only 6% of the for-profit plans. As would be expected, HMOs owned or sponsored by an AMC were far more likely to be directly involved in

GME than those not owned or sponsored by an AMC.

From the column in Table 1 that is next to the right column, it is also possible to glean information about the characteristics of those prepaid health care environments in which residents were most likely to receive training. Of those HMOs directly involved in GME in 1990, about 76% were staff or group models; 65% had more than 50,000 enrollees; 71% were eight years old or older; a disproportionate number were located in the Mountain/Pacific region (includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming); more than three-fourths were not-for-profit; and less than one out of five was owned or sponsored by an AMC.

The 42 plans that indicated they were directly involved in GME were asked to provide specific information concerning the number of residents receiving ambulatory care training, categorized by postgraduate year. As shown in Table 2, a total of 934 residents received some ambulatory training during fiscal year 1990 in one of the 24 HMOs responding to this question. The majority of these residents were in their first, second, or third year of training. The average number of residents (across all years of training) per HMO was 39, but this varied across HMOs from one resident to 312 residents, with the majority of the 24 respondents indicating that they served as an ambulatory care rotation site for 20 or fewer residents.

HMOs directly involved in GME were also asked to provide information on the number of their residents by area of specialization. In general, more HMOs were involved in family medicine and general internal medicine residency training than in other specialties, although HMO involvement was widespread across a number of specialties. Fifty-four percent of the 41 HMOs responding to this question serve as ambulatory care rotation sites for family medicine residents; 56% for general internal medicine residents; 44% for pediatrics

idents; 44% for surgery residents; 34% for obstetrics/gynecology residents; and 34% for residents in a variety of other medical specialty areas.

For the most part, HMO ambulatory care training took place in multi-specialty, group practice settings consisting of four or more physicians (see Table 3). Thirty-one percent of the 42 HMOs indicated that ambulatory care training took place in very large group practice settings of more than 50 physicians. Eighty-eight percent of the 42 HMOs indicated that residents were supervised in the ambulatory care settings; the remaining five HMOs either did not respond to this question or indicated that they did not know whether supervision was provided. Faculty generally received partial or full compensation from the HMO for their time devoted to supervision.

Plans with direct involvement also were asked to rate various benefits to the HMO. Three-fourths of the respondents felt that GME contributed either some or greatly to enhanced patient care. Over 85 percent indicated that GME contributed to the ongoing education of the HMO's participating physicians. Four-fifths of the respondents perceived benefits in terms of physician recruitment and the enhanced image of the HMO within the community. Other benefits reported included fostering a positive relationship with area hospitals, consultants, community physicians, and medical schools; and the orientation of new physicians to the concept of managed care.

When asked to indicate the rate of retention of residents by the HMO upon completion of their graduate training, 36% of plans either did not respond to this question or indicated that their involvement in GME was too recent for them to know whether residents would be retained after completion of their training. Thirty-six percent of the respondents reported a retention rate between 1% and 20% of residents, 2% reported between 21-40%, 10% reported between 41% and 60%, and 7% reported more than 60% retention of residents.

Table 2
Characteristics of Residents, by Postgraduate Year, Who Received Some Training at Health Maintenance Organizations (HMOs) during 1990*

Year of Training	No. of HMOs	No. of Residents	% of Residents	Residents per HMO		
				Mean	Median	Range
First	14	246	26	18	6	1-90
Second	16	258	28	16	5	1-91
Third	17	227	24	13	4	1-66
Fourth	8	118	13	15	3	1-46
Fellows	9	85	9	9	4	1-31
All years	24	934	100	39	5	1-312

*To ascertain the extent to which HMOs are involved in graduate medical education (GME), the authors surveyed the 481 prepaid health plans in the United States that had been in operation four years or more; 281 responded. Of these 281 respondents, 42 reported some form of GME involvement. These 42 plans were asked to indicate the number of full-time equivalent residents and fellows on-site at the HMO on a given day between July 1989 and June 1990, but only 24 were able to provide this detailed information. The table presents data about these 24 plans.

Table 3
Numbers and Percentages of Health Maintenance Organizations (HMOs) Involved in Graduate Medical Education (GME), by Site Characteristics

Site Characteristic	HMOs Involved in GME	
	No.	%
Office setting		
Small office (3 or fewer physicians)	2	5
Group practice of 4 to 25 physicians	16	38
Group practice of 26 to 50 physicians	7	17
Group practice of >50 physicians	13	31
No response	4	10
Total	42	101†
Specialty		
Single specialty	11	26
Multispecialty	27	64
No response	4	10
Total	42	100
Residents' supervision		
Supervised in ambulatory setting	37	88
Not supervised in ambulatory setting	0	0
No response	5	12
Total	42	100
Payment of faculty supervisors		
Fully paid by HMO	19	45
Partially paid by HMO	6	14
Not paid by HMO	12	29
No response	5	12
Total	42	100

*To ascertain the extent to which HMOs are involved in graduate medical education (GME), the authors surveyed the 481 prepaid health plans in the United States that had been in operation four years or more; 281 responded. The 42 plans that reported direct GME involvement were asked to provide descriptive information; some of this information is presented in this table.

† Does not equal 100% because of rounding.

Ten percent said their retention rate was zero.

Plans not directly involved in GME (239 of the 281 plans responding to the survey) were asked to provide information on any "indirect" involvement they may have had in GME. Fourteen percent of the plans not directly involved in GME indicated that HMO physicians taught at an academic medical center or teaching hospital on HMO time; 62% had physicians who taught on their own time; and 9% were part of a larger health system involved in graduate medical education.

Discussion

These findings make apparent that prepaid health care plans are woven into the fabric of GME through a multitude of arrangements. Direct involvement in GME is no longer the exclusive purview of a limited number of HMOs closely linked to AMCs. HMOs owned or sponsored by an AMC are more likely than other HMOs to be directly involved in GME (in 1990, just over one in three participated in GME). But HMOs that are owned or sponsored by an AMC constituted only about 15–20% of all HMOs directly involved in GME.

Although many more HMOs "of all stripes" have become involved in GME during the last two decades, HMOs' impact on GME is still quite limited. The survey results indicate that about 15% of HMOs four years or older are directly involved in GME, and, on average, each of these HMOs provides some training for about 39 residents in any given fiscal year. Assuming the results of the survey are generalizable to all HMOs, this would imply that no more than 2,800 residents receive training in an HMO environment in any given fiscal year. This is but a fraction of the estimated over 36,000 residents in a given year enrolled in a residency program in family practice, internal medicine, obstetrics/gynecology, or pediatrics.¹⁸

If a sizable proportion of residents are to receive experience in ambulatory care settings that provide all or a

significant proportion of services to HMO enrollees, it will be necessary to find ways to increase the number of HMOs directly involved in GME.

Certain HMO characteristics are associated with a greater likelihood of involvement in GME. HMOs directly involved in GME are more likely to be staff and group model HMOs, rather than IPAs. One possible explanation for this finding is that the organizational structure of some IPAs may not be conducive to the more formal, direct types of involvement that were the primary focus of this survey. IPAs contract with individual physicians or with groups of physicians that may or may not practice as a group. In general, the participating physician network for an IPA is more decentralized; primary care services are provided in many different office or clinic settings; and participating physicians derive practice income from a variety of sources in addition to the HMO. An IPA may or may not be aware of its participating physicians' involvement in GME, which is less likely to be indicative of an HMO policy and more likely to reflect individual physicians' preferences and relationships to the broader medical community.

Lower levels of direct involvement on the part of IPAs may also be attributable to the fact that IPAs are on the average younger and smaller than group and/or staff models, and the likelihood of an HMO's getting involved in GME increases with its age and enrollment size. In 1990, a survey¹⁵ of HMOs at least three years old found the average age of IPAs to be 6.6 years, as compared with 17.4 years for staff models and 13.5 years for group models. The median enrollment for these IPAs was 25,732, compared with 43,137 for staff models and 55,337 for group models. Presumably larger, mature HMOs are more financially stable, and probably also in a better position to provide residents with greater breadth and depth of clinical experience.

With regard to the various types of GME arrangements, it is apparent that only a minority of HMOs have sought or are eligible to receive ac-

creditation by the ACGME to serve as a sponsoring organization for a GME program. The very few HMOs that do sponsor GME programs tend to be larger and older HMOs, and, as would be expected, ones that own their own hospitals.

Perhaps the greatest opportunity for increasing HMO involvement in GME rests with the development of more affiliation agreements between HMOs and AMCs and/or teaching hospitals. As discussed above, successful affiliation agreements require that HMOs and AMCs and/or teaching hospitals have a clear understanding of each other's missions and objectives, and of the benefits and costs each party is likely to derive from involvement in GME.

It will also be necessary to overcome other barriers to increased training in all ambulatory care settings, most notably, the lack of adequate financial support.⁴ The introduction of residents to an ambulatory care setting increases operating costs and decreases productivity, especially if the residents are in the first or second year of training.^{4,17} At present, the major part of the support for graduate medical education is tied to hospital inpatient revenues, and effective methods of channeling the flow of these or other funds to support ambulatory-based education have yet to be found. National medical education leaders have also expressed concern about the need to assure the integrity of ambulatory educational experiences through the recruitment of qualified faculty for ambulatory care sites, the delineation of learning objectives for ambulatory care settings, and the establishment of communication mechanisms between faculty at academic medical centers and faculty and residents at ambulatory care sites.¹⁸

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ROGER A. ROSENBLATT, M.D., M.P.H.

The Potential of the Academic Medical Center to Shape Policy-oriented Rural Health Research

Abstract—Rural communities continue to have problems in gaining access to basic health care services, a problem exacerbated by persistent shortages of physicians, financially threatened rural hospitals, and weak local economies. Academic health centers can help to address these issues, not only by increasing the flow of their graduates to rural areas, but also by supporting health services research designed to shape public policy that affects the rural United States. Examples of such research in-

clude experiments designed to influence the locational decisions of medical students and residents, studies of the quality and cost-effectiveness of care in rural hospitals, and the testing of new ways to provide emergency medical care in rural areas. Such policy-oriented research is compatible with both the intellectual and the service missions of most medical schools; in addition, lessons learned in rural areas may be relevant in more urbanized areas. *Acad. Med.* 66(1991):662-667.

There is a tension between the central mission of America's academic health centers and this nation's need to develop stable health care systems in rural parts of the country. Academic health centers are for the most part urban institutions, dependent on their cosmopolitan settings for their flows of patients, money, and ideas. The clinical care and research performed in our medical schools is highly specialized, and the graduates of our teaching institutions tend to follow in the footsteps of their mentors and role models. Relatively few of the graduates of these schools diffuse to rural communities, where the need for practitioners is acute.

This persistent inability of our medical schools to meet rural health care systems' needs for medical personnel serves neither partner well. Rural health care systems are in crisis, and our medical schools are neglecting an element of medical care service, teaching, and research that has great relevance for all academic

medical centers, no matter where they are situated or what their missions. A large portion of medical care in this country consists of primary care encounters between physicians and patients; and a substantial amount of the medical endeavor—both primary care and secondary and tertiary care—takes place in areas that are rural. As the major source of trained medical practitioners, we in academic medicine should be interested both in producing pertinent knowledge that future practitioners can use in the field and in making sure that we equip our graduates with this knowledge when they emerge from institutions into a world that has many hues and many venues.

The objective of this article is to convey a sense of the relevance and challenge of policy-oriented research in rural health care, the pertinence of this research to the central mission of the academic health center, and the opportunities that exist to obtain substantial support for incorporating this policy-oriented research thrust within our broader scholarly agenda. As the nation has belatedly focused on the necessity for improving access to care within the constraints of limited resources, it has become increasingly important to increase our understanding of the natural history of commonly encountered diseases. In addition, it has become equally important to enhance our ability to respond efficiently to the patients with those diseases and to create a delivery system that ensures that the entire population can benefit from those interventions. Rural health research

designed to shape public policy is an excellent example of an activity that ties many of these themes together. (For an overview of the different areas of such research, see the list later in this article in the section entitled "Promising Research Areas.")

Rationale for a Rural Focus

What is the rationale for singling out rural health as a separate area of inquiry, particularly in a technologically advanced country such as the United States? Certainly the basic biological verities apply with the same force in rural as in urban areas. With a few notable exceptions, differences in disease prevalence do not justify designating rural health care a separate area or endeavor.

The major reason that it is worthwhile to focus our intellectual microscopes on rural America as a separate subject of study is that there are differences in the way health services are delivered in rural areas. The differences are the direct consequences of the topographic and demographic features by which we define "rural." A useful if imprecise definition is that rural areas are those places with relatively low population densities that are relatively isolated from major metropolitan centers. The two variables by which we define a place as urban or rural—population density and distance from population centers—are both continuous variables, and the ultimate designation is as much a cultural as a scientific decision.

Even though the concept of rural may be relativistic, it is possible and

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Another article about rural health care appears on page 682.

necessary to develop mechanisms to identify which populations will be categorized as rural for the purposes of research. The federal government has developed two similar but not identical approaches for the definition of rural populations, one of the sources of confusion about the statistics. The Census Bureau defines the rural population as that part of the population not living in urban areas—a novel and creative approach! Urban areas are defined as central cities and their suburbs and surrounding towns with at least 2,500 people. About 25% of the U.S. population is rural by this definition. The major problem with this definition is that a town of 2,600 people is considered urban, which violates our intuitive sense of the difference between urban and rural communities.

The more commonly used—and the more useful—definition is not promulgated by the Census Bureau but by the Office of Management and Budget. In this definition, the country is divided into metropolitan statistical areas (MSAs) and non-MSAs. The definition of an MSA is a county or group of counties with a city of 50,000 or more residents (similar to the Census Bureau's definition of an urbanized area) or an urbanized area with at least 50,000 people that is part of a county or group of counties with at least 100,000 people. Although this tongue twister of a definition is a bit convoluted, many of the data describing rural areas in standard texts and papers are really data about non-MSAs. Even though most of the land mass of the United States is rural, most of the population lives in urban areas, and urbanization has been one of the most powerful demographic trends in this country since the turn of the century.

Yet the fact that the population is mostly urban does not mean that the number of people living in rural settings is insignificant. As can be seen in Figure 1, the total rural population has actually remained the same or increased slightly as the United States has grown. About 50 million people live in nonmetropolitan areas. The farm population has shrunk radically,

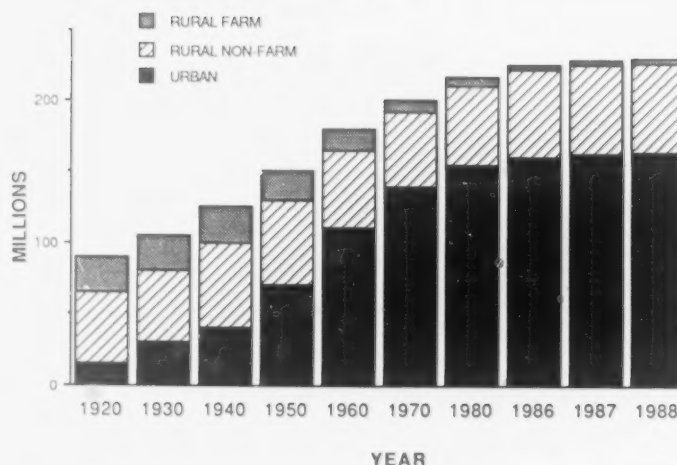


Figure 1. U.S. rural and rural farm populations, selected years, 1920–1988.

but the number of rural Americans remains substantial.

Despite the difficulty of crisply defining rural, the contrast between urban and America is not merely a theoretical construct in the mind of geographers. It has intensely practical implications. The five most urban states have less than 10% of their populations in rural areas; the five most rural states have more than 70% of their populations in rural areas.

When translated into population density, the contrast is striking. As seen in Figure 2, the most densely populated state—Rhode Island—has almost 200 times the number of people per square mile as does the most rural state, Wyoming. But even Rhode Island has pockets of rural communities, and some of these communities have difficulty obtaining ready access to local health care services. Moreover, even among the most rural states there are enormous disparities, with Vermont, for example, having a large proportion of people spread evenly across the landscape without the enormous distances that characterize the western states.

Rural Health Care Delivery

What are the consequences of low population density and isolation for

the delivery of health services? From a conceptual standpoint, it is critical to recognize that the effects of rurality on health care services are merely a special case of the effects of rurality on the production and distribution of all other goods and services in sparsely populated areas. The two major ways by which we define a rural area each describe situations that exact additional burdens and costs in the production of goods and services. Isolation makes it more difficult to attract people with special skills and talents to rural areas, increases the cost of accruing raw materials, and adds its own tariff in the distribution of products. Low population density is a direct cause of relative diseconomies of scale, in which the unit cost of producing any item tends to be higher because optimal efficiencies cannot be achieved. This applies with equal validity to the production of widgets for use in automobile manufacture, to the maintenance of schools or highways, and to the establishment of a health care system.

The recent rebirth of interest in rural America in general, and rural health in particular, is a consequence of a precipitous decline in the economic and demographic fortunes of rural areas during the 1980s. This decline was the more dramatic because

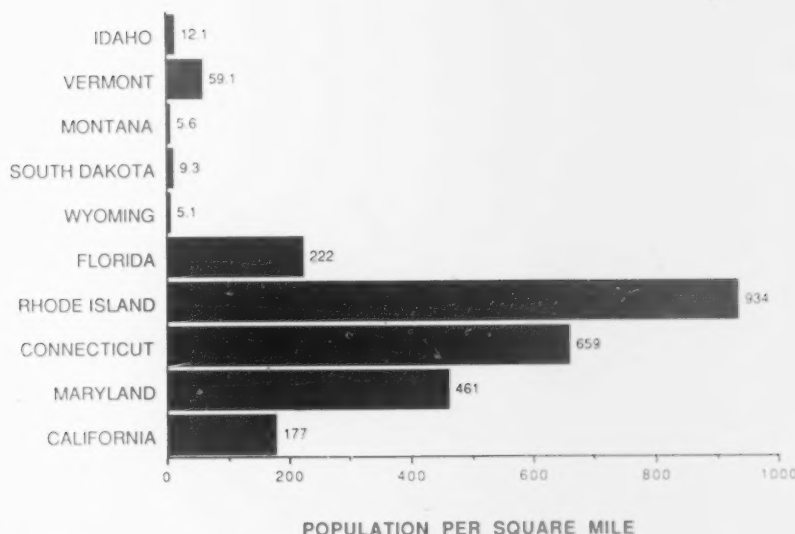


Figure 2. Population densities of the five most rural and five most urban states.

the previous decade had been characterized by a brief rural renaissance, in which there was a substantial migration of people and economic opportunities to rural areas. Unfortunately, the 1970s proved to be the exception to the more general trend, and the laissez-faire economic policies of the Reagan years contributed to a situation where rural population growth, employment rates, and income lagged far behind that of urban areas. These doldrums were caused by the same structural factors that led to deterioration of the status of health services in rural areas.

The persistent economic instability of rural America has made it difficult to preserve—much less create—viable health care systems and stable retinues of health care providers. One of the main problems is that there is a fundamental tension between the relative economic simplicity of individual rural communities and the increasingly intensive technological nature of the medical endeavor. Rural economies are largely extractive. In the West, for example, they tend to be based on such industries as lumber, agriculture, mining, and cattle—commodities that come from the land.

Although each of these industries has experienced a significant increase in technological sophistication over recent years, the end products today differ little from their predecessors decades ago.

Medicine, by contrast, has changed radically. The capital intensity of hospitals and physicians' offices has accelerated in recent years, driven by new capabilities, expanding patient expectations, and competition within the industry based more on product line than on price. These differences in the characteristics of basic rural economics and the technological sophistication of the medical enterprise have collided, with many rural towns unable to support the entry costs of maintaining a modern medical system.

Promising Research Areas

There are many ways in which one can organize an approach to the exploration of rural health issues, each of which has some intuitive or theoretical appeal. However, from a purely pragmatic standpoint, it makes sense to refer to a format (in the list soon to follow) that has been

adopted by the Agency for Health Care Policy and Research (AHCPR), the federal agency that supports many of the research endeavors in rural health issues.

In December 1987, the federal government sponsored a conference in San Diego that was convened by the National Rural Health Association and the Foundation for Health Services Research. The purpose of the conference was "... to identify gaps in the knowledge base of rural health service issues, and develop a rural health services research agenda that could ... provide guidance to federal policymakers."¹

The following nine areas for rural health research represent an expanded version of the roster developed at this conference. Although this list is not sacrosanct and the author's explanations of the areas are broad ones only, it is a useful list and has considerable appeal.

Health personnel and primary care. Studies in this area involve the training, deployment, and support of health personnel for rural areas, with special attention to the roles and functions of different health professionals and the adequacies of supplies in different areas.

Rural emergency medical services. Studies in this area involve optimal responses to emergent and life-threatening accidents and illnesses in rural areas, with a focus on the pre-hospital and institutional capabilities that can be sustained in sparsely populated areas.

Rural hospital structure and function. This research area involves an exploration of the role and function of rural hospitals, including attention to issues of scope of services, quality, organizational efficiency, governance, cost, appropriateness, and reimbursement.

Maternal and child care. Studies in this area concern the provision of basic obstetric, neonatal, and pediatric services in rural areas, with special attention to the prevention of disease and the design of regionalized perinatal care systems for the care of very small or very sick newborns.

Rural poor and uninsured. This re-

search area involves the study of insurance and reimbursement systems that address the disproportionately large number of rural dwellers who live in poverty and lack health insurance, with an emphasis on developing and evaluating innovative approaches to these persistent structural problems.

Rural elderly and long-term care. Studies in this area concern geriatric care in rural populations in the ambulatory, hospital, and long-term care settings.

Mental health services. This area of research explores the epidemiology of mental illness in rural communities and the provision of basic mental health services by a variety of professionals and paraprofessionals.

Racial and ethnic minorities. This area would include studies of specific racial and ethnic groups—such as Native Americans and Hispanic migrant workers—whose members are found in specific rural areas and have specific health problems compounded by difficulty in gaining access to health care services.

"Alternative" delivery systems. This area of research would focus on the design, testing, and evaluation of new organizational forms for the delivery of health services, including attempts to modify health maintenance organizations in their various forms to be effective in rural environments.

Although it is impossible to delve into all nine areas in depth, it is worthwhile to discuss some of the issues that are inherent in the top three. This will illustrate some of the richness of potential policy-relevant research that can be done in the area of rural health and some of the ways these issues can be approached.

Health Personnel and Primary Care

The first area, health personnel and primary care, is probably the one most closely related to the educational activities of academic health centers.

The shortage of health manpower is the persistent Achilles heel of rural health, not only in the United States in this era, but in all countries as far

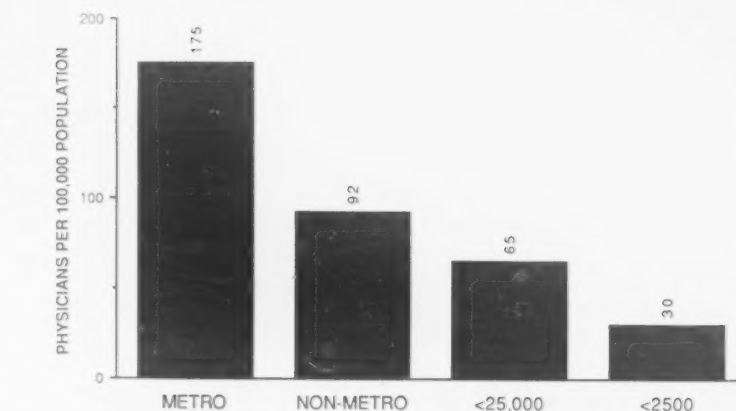


Figure 3. Physician supply by rural and urban location, United States, 1988.

back as one looks. Trying to understand and address the relative shortage of health personnel in rural areas is a fertile area for further research. Such efforts might include creating and rigorously studying carefully constructed educational interventions within medical schools, designed to increase the proportion of students who would establish their practices in rural areas.

The statistics are stark (see Figure 3). There is a linear relationship between population density and the relative supply of physicians. The more rural the area, the fewer physicians are available.

A major source of this discrepancy in physician supply has to do with the relationship between the type of specialty choice and practice location. That is, general and family physicians distribute themselves in proportion to the overall population, while the further one's specialty is from primary care, the more likely one is to locate in a major urban area. The reasons for this involve the technological and capital intensity of specialized medical endeavors, the propensity of physicians to remain tethered to the institutions where they trained, the relative wealth of the urban areas, and the much more familiar urban cultural milieu. The problems have been with us a long time; the answers remain elusive and deserve more investigation.

For example, we know that is possible to influence the specialty choices of graduating medical students and the locational decisions of graduating residents through educational and reimbursement policies. A number of medical schools throughout the country have focused on this approach, some with more than modest success. Yet it isn't a simple process, and it usually isn't a concern central to the leaders of most of our academic health centers. The major question for the academic medical centers is whether this issue is one that medical schools will place high enough on their priority lists to address meaningfully or whether they will leave it to state and federal entities to cajole, bribe, or threaten them into making this a central element of the educational service mission. Research can be useful in increasing our understanding of how academic medical centers can effectively address the issue of influencing specialty and practice location choices, and can be encouraged if the medical centers provide traditional academic rewards to investigators who pursue such research.

Emergency Medical Services

The second major topic for research is that of emergency medical services (EMS). The sine qua non of the rural medical care system is its ability to

provide emergency services. Rural residents will fight tenaciously to preserve their local hospitals, even though many of those residents will bypass the facility for routine care. Their major motive is to maintain the capability of the system to respond to emergencies.

The statistics underline the logic of this attitude. Many of the industries common in rural areas are associated with high injury and death rates, including farming, mining, and forestry. Despite the high rates of occupationally related injuries, rural areas are handicapped in their ability to deal with these injuries. The essential definition of an emergency is that the condition of the victim deteriorates rapidly with time. The success of the medical intervention is directly related to the speed with which the victim receives appropriate care, but delays are inevitable in sparsely populated areas. This combination of increased rates of injury and less effective systems can be seen in the relative death rates from auto accidents, which are much higher in rural areas.

Despite this need for improved EMS systems, the rural EMS system capability has actually deteriorated with the waning of federal and state funding for local services. This is reflected in the extent to which states—particularly rural states—fail to meet the criteria established for regional trauma systems. According to data from the American College of Surgeons, only two states have all eight components of a regional trauma system, and the majority of states have *none* of the components.

This is an area where the academic medical centers can provide substantial leadership. Most of them are involved in running sophisticated urban trauma centers, often as part of a system of public hospitals. It would seem a logical extension of their role to become more involved in designing and implementing rational, regionalized emergency medical care systems. Part of the responsibility is not only to wait passively for those patients who appear in emergency departments, but to help the remote hospitals and

physicians build the capability to appropriately resuscitate, stabilize, and transport those patients who will ultimately benefit from our tertiary capabilities. Specific research projects could focus on the quality of care rendered in different settings, the identification of types of avoidable mortality, the testing of new means of stabilization and transport, and changes in the training and deployment of EMS personnel.

Rural Hospitals

The third major area is the rural hospital. It has probably been the distress of rural hospitals following the enactment of legislation mandating prospective payment and diagnosis-related groups (DRGs) that has most galvanized political attention to rural health care. There are good reasons for this. Not only is the rural hospital one of the most important economic institutions in many small towns, but until recently the rural hospital was a prerequisite for creating any kind of stable rural health care system.

The rural hospital over the last decade has been a beleaguered institution. Twenty years ago rural hospital acted like miniature versions of urban hospitals, with the major distinction being smaller volumes. This is no longer true. The rural hospital in today's technologically intense world must define a unique role for itself, a core set of basic services that it can offer to meet the basic needs of the rural populations it serves. It must also acknowledge that there are a number of very technologically intense services that it would be better not to try to incorporate into its repertoire. The experience of the University of Washington with the Kellogg WAMI Rural Hospital Project and with the Area Health Education Center's Community Health Service Development Project reinforces a conviction that it is possible to define such a role.

But the rural hospital has faced another set of problems that derive from the tenuous financial stability of these institutions. The passage of the Medicare Prospective Payment Laws

in 1983 totally changed the rules of the game and plunged rural hospitals nationwide into a sea of red ink. Small rural hospitals as a class went into collective bankruptcy. Although urban hospitals saw their profit margins pared, they remained solvent, while many rural hospitals were no longer financially viable.

Not surprisingly, these vulnerable institutions have not all survived this financial stress. The extent of the problem can be appreciated by looking at the pattern of rural hospital closings over recent years. Two hundred ninety-eight rural hospitals closed their doors between 1980 and 1989, and no part of the country was untouched. Ten percent of all rural hospitals in the United States closed within the past decade, and the rate of closure continues to accelerate. A key public policy objective should be to sustain appropriate rural hospitals as part of rationally designed rural health care systems. Hospitals should be saved not simply for their own sakes, but because they anchor all the bits and pieces of a health care system that mean adequate and appropriate care for rural communities: doctors, ambulances, emergency rooms, diagnostic facilities, and often nursing homes. The rural hospital needs to go through a logical transformation so that it fits within a modern medical system, but it shouldn't be eradicated. To accomplish this transformation, research will be needed into the organization and functioning of rural hospitals, with special attention to the quality and cost-effectiveness of specific types of care.

This is another area in which the academic medical center can provide leadership. Although most tertiary teaching hospitals are remote from the small rural hospitals that are in distress, there are linkages through patient referral, the diffusion of medical school and residency graduates, and ties through professional associations. Much of the expertise within the academic health center is relevant to rationalizing the operations of smaller facilities, and cooperation between teaching hospitals and a network of rural hospitals can be mutu-

ally beneficial. Academic medical centers already see themselves as regional resources for clinical care and medical education; extending the definition to include the sustenance of rural health care systems is a logical extension of their already important regional roles.

Conclusion

There are a number of reasons that the area of rural health care research is a very exciting area of inquiry for faculty in academic health centers. First, it is intellectually stimulating. Rural settings are microcosms of the larger world, with the problems of sparse population and isolation thrown in. Trying to design rational and efficient systems of care and understanding the interaction between human populations and the environments in which they live bring up some of the most important problems that confront not only our health care

system but society in general.

Second, research in this area can make a difference. Rural settings, for all their complexity, are often much simpler than their urban counterparts, which have interwoven and sometimes immovable characteristics. At the University of Washington we have had the experience repeatedly over the last two decades of seeing research translated into public policy. Sometimes the translations have had only a tangential relationship to the original work, but at least we're working in a field where people are paying attention and where palpable changes can be made in relatively short time frames. Descriptions of the university's experiences in this area are beyond the scope of this paper, but the author will be glad to provide such descriptions to interested readers.

Last, the answers that are extracted from rural health care research can often be extrapolated to

urban populations in this country and to other countries with different health care systems. The problem of designing appropriate and cost-effective health care systems within set resource constraints is not, after all, primarily a rural problem. I would suggest that we embrace the rural parts of our service areas as laboratories in which to try new experiments in medical education, health services delivery, and community involvement. Not only will we improve the quality of life in the regions which we serve, but we may learn things that we can bring back and apply in our home institutions.

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ORIGINAL CONTRIBUTIONS

ARTICLES

Where Physicians Practicing in Appalachia in 1978 to 1990 Were Trained and How They Were Distributed in Urban and Rural Appalachia

ALLAN ROBERTS, Ph.D., LAURENCE DAVIS, Ph.D., and JAMES WELLS, Ph.D.

Abstract—Medical school graduates who graduated from 1978 to 1986 were analyzed to determine the health professions' ability worldwide to educate and place primary care physicians in rural areas of Appalachia. These data indicate that the University System of West Virginia—consisting of the West Virginia School of Osteopathic Medicine, West Virginia University Medical School, and Marshall University Medical School—produced the most primary care physicians who began practicing in rural Appalachia during the 1980s. The West Virginia School of Osteopathic Medicine successfully retained 106 (26%) of its gradu-

ates in primary care practices throughout rural Appalachia, with 77 of them in rural West Virginia, making the institution the nation's leading provider of primary care physicians practicing in rural Appalachia and West Virginia during this eight-year study period. With the exception of West Virginia, these and additional data support concerns of medical educators and public health officials that physicians in Appalachia are distributed disproportionately, more to urban than to rural counties. *Acad. Med.* 66(1991):682–686.

The ability of a state to retain its medical school graduates is related to highly complex interactions among the school, the state, and the individual physicians. Training and retention of physicians, particularly of primary care physicians who return to practice in rural and underserved regions of the United States, has proven to be an extremely difficult task for medical educators and public health departments.^{1–4}

The rural areas of the United States, especially Appalachia, have pronounced health care problems, with the poor distribution of physi-

cians being one contributing factor.⁵ The need for educating, training, and retaining doctors who will serve these people is crucial.

This paper presents available data from 1978 to 1990 concerning (1) the institutions (worldwide) that trained the physicians—especially primary care physicians—who were practicing in Appalachia, and (2) the physicians' distribution in the rural and urban areas of that region.

Defining Appalachia

The Appalachian region has been most consistently defined by the Appalachian Regional Development Act⁶; it includes all of West Virginia and parts of New York, Pennsylvania, Maryland, Virginia, Ohio, Kentucky, Tennessee, North and South Carolina, Georgia, Alabama, and Mississippi. It incorporates 397 counties in the 13 states included in this study.

Sources of Data

Methods developed by the U.S. Bureau of the Census for categorizing

counties as metropolitan (urban) or nonmetropolitan (rural) are used throughout this study. Standard Metropolitan Statistical Areas (SMSAs) are areas with one city having a population of at least 50,000, or a city with a population of 25,000 and contiguous regions of at least 1,000 people per square mile and a combined total of 50,000 people.⁷

The American Medical Association (AMA) and the American Osteopathic Association (AOA) have compiled professional and practice-related information on all physicians in the United States. These files are now available for research on physician manpower and health-related matters and were used as primary sources of information for the findings presented in this study. Physician file data are obtained from both AMA and AOA surveys and input from physicians and other organizations and institutions. These data are managed by the Division of Survey and Data Resources of the AMA and the AOA, which are responsible for the ongoing maintenance and updating of individual physicians' records.

Physicians' data are provided to

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Another article about rural health care appears on page 662.

the AMA and AOA divisions of Survey and Data Resources by primary sources, including medical schools, hospitals, medical societies, the National Board of Medical Examiners, state licensing agencies, the Educational Commission of Foreign Medical Graduates, the Surgeon General of the United States, the American Board of Medical Specialties, and physicians' and medical groups. The AMA and AOA physician files use data from primary sources only; information is entered after it is verified by a primary source.

Method

Data were collected in the present study by retrospectively following all graduates of medical schools (worldwide) from the years 1978 to 1986 who began practicing in Appalachia, as listed in AMA (June 1990) and AOA physician files (September 1989). In addition, for cross-checking purposes, data were obtained for all the West Virginia School of Osteopathic Medicine (WVSOM) graduates from 1978 to 1986 through review of the alumni placement files and the physician files of the WVSOM.

The findings reported here are based on responses to requests for the numbers of graduates of individual medical schools who were non-federal physicians and who were practicing in each of the county groups (non-SMSA or SMSA). Those physicians in internships, residencies, and military service were excluded. All active non-federal allopathic (M.D.) and osteopathic (D.O.) physicians in patient care and the specialties of family practice and general practice, internal medicine, pediatrics, and obstetrics and gynecology were defined as primary care physicians. These physicians, as well as those in all other physician practice specialties, were included in the study's analyses of medical school graduates from 1978 to 1986.

Findings

Table 1 shows the numbers of graduates (1978 to 1986) from all medical schools worldwide who had rural and urban primary care practices in Appalachia during the period of this study. The ten schools having the most graduates practicing in rural counties are shown by name, and ad-

ditional data are presented about their graduates.

The West Virginia School of Osteopathic Medicine, West Virginia University Medical School, and the University of Mississippi Medical School ranked first, second, and third, respectively, in the percentages of their graduates with primary care practices in rural Appalachia. The West Virginia School of Osteopathic Medicine, the University of Alabama School of Medicine, and the West Virginia University Medical School ranked first, second, and third, respectively, in the percentages of all their graduates returning to practice as primary care physicians throughout all of Appalachia (rural and urban).

When actual numbers of primary care physicians returning to rural areas of Appalachia are considered, the West Virginia School of Osteopathic Medicine led all other schools by returning 106 of its graduates. The University of Mississippi School of Medicine, the University of Alabama School of Medicine, and the Medical College of Georgia were next, with 68 graduates each. Data from all schools (worldwide) indicate that the total

Table 1
Numbers and Percentages of Graduates (1978-1986) with Primary Care Practices in Appalachia from the Ten Medical Schools That Produced the Most of Such Graduates*

Schools§	Rural†		Urban‡		Rural and Urban		Total No. Graduates in All Specialties Practicing in United States
	No.	%	No.	%	No.	%	
WV School of Osteopathic Medicine	106	25.4	53	12.7	159	38.1	417
U. Mississippi School of Medicine	68	6.7	30	3.0	98	9.7	1,011
Medical College of Georgia	68	5.5	57	4.6	125	10.1	1,240
U. Alabama School of Medicine	68	6.1	239	21.6	307	27.7	1,107
WV U. School of Medicine	65	10.7	84	13.8	149	24.4	610
Philadelphia College of Osteopathic Medicine	61	6.4	123	12.9	184	19.3	952
U. Tennessee School of Medicine	55	4.8	124	10.9	179	15.7	1,141
U. Kentucky School of Medicine	48	6.4	23	3.1	71	9.5	745
U. Louisville School of Medicine	47	4.6	25	2.4	72	7.0	1,024
U. Thomas Jefferson School of Medicine	47	3.2	83	5.7	130	9.0	1,449
All schools worldwide	1,665		2,997		4,662		130,855

*The authors assembled available data to determine which medical schools worldwide were mainly responsible for training and placing physicians—especially those in primary care specialties—in Appalachia. The table lists the ten medical schools that had the most graduates practicing primary care in rural counties from 1978 to 1986.

† "Rural" means a non-Standard Metropolitan Statistical Area.

‡ "Urban" means a Standard Metropolitan Statistical Area.

§ The schools are listed in descending order of the number of their graduates practicing in Appalachian rural areas.

Table 2
Numbers and Percentages of Graduates (1978-1986) in Any Specialty Practicing in Appalachia from the Ten Medical Schools That Produced the Most of Such Graduates*

School§	Rural†		Urban‡		Rural and Urban		Total No. Graduates in All Specialties Practicing in United States
	No.	%	No.	%	No.	%	
WV U. School of Medicine	128	21.0	174	28.5	302	49.5	610
WV School of Osteopathic Medicine	126	30.2	73	17.5	199	47.7	417
Medical College of Georgia	106	8.5	106	8.5	212	17.1	1,240
U. Mississippi School of Medicine	99	9.8	60	5.9	159	15.7	1,011
U. Alabama School of Medicine	97	8.8	433	39.1	530	47.9	1,107
U. Tennessee School of Medicine	91	8.0	242	21.2	333	29.2	1,141
U. Thomas Jefferson School of Medicine	77	5.3	167	11.5	244	16.8	1,449
Philadelphia College of Osteopathic Medicine	72	7.6	159	16.7	231	24.3	952
U. Kentucky School of Medicine	68	9.1	44	5.9	112	15.0	745
U. Louisville School of Medicine	63	6.2	36	3.5	99	9.7	1,024
All schools worldwide	2,654		5,820		8,474		130,855

*The authors assembled available data to determine which medical schools worldwide were mainly responsible for training and placing physicians—especially those in primary care specialties—in Appalachia. The table lists the ten medical schools that had the most graduates in any specialty practicing in rural counties from 1978 to 1986.

†"Rural" means a non-Standard Metropolitan Statistical Area.

‡"Urban" means a Standard Metropolitan Statistical Area.

§The schools are listed in descending order of the number of their graduates practicing in Appalachian rural areas.

number of primary care physicians going to urban areas within Appalachia (2,997) was greater than the total number of those practicing in rural Appalachia (1,665).

Table 2 shows the number of all 1978-1986 graduates, no matter what specialty they chose, who were practicing in the rural and urban areas of Appalachia during the time span of this study. Only the ten medical schools having the most graduates practicing in rural counties are shown by name in this table, along with additional data about their graduates. The West Virginia School of Osteopathic Medicine, the West Virginia University School of Medicine, and the University of Mississippi Medical School ranked first, second, and third, respectively, in the percentages of all physicians practicing in rural Appalachia, whereas West Virginia University Medical School, the University of Alabama School of Medicine, and the West Virginia School of Osteopathic Medicine ranked first, second, and third, respectively, when rural and urban counties were combined.

When actual numbers of all physicians returning to rural areas of Ap-

palachia were considered, West Virginia University Medical School, the West Virginia School of Osteopathic Medicine, and the Medical College of Georgia were the top three institutions. Comparison of the numbers of all physicians going to rural as opposed to urban Appalachia indicates that when physicians from all schools (worldwide) are considered, 2,654 went to rural areas and 5,820 to urban sites.

Table 3 shows the numbers of graduates with urban and rural primary care practices in West Virginia only. All of West Virginia is defined as being a part of Appalachia; it is the only state to be so designated by the Appalachian Regional Commission.⁶ Only those schools having four or more graduates practicing as primary care physicians in rural counties are shown by name in this table, and additional data are presented about their graduates.

As might be expected, West Virginia's three medical schools supplied the majority of primary care physicians practicing throughout West Virginia, with the West Virginia School of Osteopathic Medicine leading its sister institutions in actual

numbers and percentages of graduates with primary care practices in rural counties. When all schools (worldwide) are considered, the total number of all primary care physicians practicing in rural areas (287) was almost two-thirds more than the number in urban sites (175).

Table 4 shows the numbers of all graduates practicing in all specialties in West Virginia. Only those schools having four or more graduates practicing in rural counties are listed by name in this table, and additional data are given about their graduates. The West Virginia School of Osteopathic Medicine, West Virginia University Medical School, and Marshall University Medical School ranked first, second, and third, respectively, in the percentages of physicians practicing in rural West Virginia.

The distribution of the total numbers of physicians to rural or urban regions of West Virginia, shown in Table 4, indicates that approximately one-third more went to rural (460) than to urban (313) areas of the state.

When the population distribution and physician distribution for all Appalachia were compared for this study, it was determined that during

Table 3
Numbers and Percentages of Graduates (1978–1986) with Primary Care Practices in West Virginia, from the 13 Medical Schools That Produced the Most of Such Graduates*

School§	Rural†		Urban‡		Rural and Urban		Total No. Graduates in All Specialties Practicing in United States
	No.	%	No.	%	No.	%	
WV School of Osteopathic Medicine	77	18.5	36	8.6	113	27.1	417
WV U. School of Medicine	58	9.5	61	10.0	119	19.5	610
Marshall U. School of Medicine¶	19	13.2	22	15.3	41	28.5	144
Medical College of Virginia COMM	7	0.7	0	0.0	7	0.7	1,062
U. Virginia School of Medicine	6	0.7	0	0.0	6	0.7	857
U. Pittsburgh School of Medicine	5	0.6	0	0.0	5	0.6	882
Loyola U. Chicago, Stritch School	5	0.6	0	0.0	5	0.6	894
George Washington U. School of Medicine	4	0.4	1	0.1	5	0.6	893
U. Maryland School of Medicine	4	0.5	0	0.0	4	0.5	881
Penn State U. School of Medicine	4	0.6	0	0.0	4	0.6	634
Temple U. School of Medicine	4	0.3	0	0.0	4	0.3	1,196
Loma Linda U. School of Medicine	4	0.4	0	0.0	4	0.4	893
New York College of Osteopathic Medicine	4	0.3	0	0.0	4	0.3	1,230
All schools worldwide	287		175		462		130,855

*The authors assembled available data to determine which medical schools worldwide were mainly responsible for training and placing physicians—especially those in primary care specialties—in Appalachia. The table lists the 13 medical schools that had the most graduates in primary care practicing in rural West Virginia counties from 1978 to 1986.

†“Rural” means a non-Standard Metropolitan Statistical Area.

‡“Urban” means a Standard Metropolitan Statistical Area.

§The schools are listed in descending order of the number of their graduates practicing in West Virginia rural areas.

¶Marshall's first class graduated in 1981.

Table 4
Numbers and Percentage of Graduates (1978–1986) in Any Specialty Practicing in West Virginia from the 16 Medical Schools That Produced the Most of Such Graduates*

School§	Rural†		Urban‡		Rural and Urban		Total No. Graduates in All Specialties Practicing in United States
	No.	%	No.	%	No.	%	
WV U. School of Medicine	111	18.2	109	17.9	220	36.1	610
WV School of Osteopathic Medicine	90	21.6	46	11.0	136	32.6	417
Marshall U. School of Medicine¶	25	17.4	28	19.4	52	36.8	144
Medical College of Virginia COMM	14	1.3	2	0.2	16	1.5	1,062
U. Maryland School of Medicine	10	0.8	4	0.3	14	1.1	1,230
U. Virginia School of Medicine	9	1.1	0	0.0	9	1.1	857
Hahnemann U. School of Medicine	7	0.6	3	0.2	10	0.8	1,216
U. Pittsburgh School of Medicine	7	0.8	1	0.1	8	0.9	894
Medical College of Pennsylvania	6	0.7	1	0.1	7	0.9	803
U. Autonoma de Guadalajara	6	0.2	3	0.1	9	0.4	2,437
U. Georgetown School of Medicine	5	0.5	2	0.2	7	0.6	1,108
U. North Carolina School of Medicine	4	0.4	0	0.0	4	0.4	1,015
Medical College of Thomas Jefferson	4	0.3	5	0.3	9	0.6	1,449
Temple U. School of Medicine	4	0.3	3	0.3	7	0.6	1,196
Wake Forest (Bowman Gray)	4	0.6	0	0.0	4	0.6	680
Penn State U. School of Medicine	4	0.6	0	0.0	4	0.6	634
All schools worldwide	460		313		773		130,855

*The authors assembled available data to determine which medical schools worldwide were mainly responsible for training and placing physicians—especially those in primary care specialties—in Appalachia. The table lists the 16 medical schools that had four or more graduates in any specialty practicing in rural counties from 1978 to 1986.

†“Rural” means a non-Standard Metropolitan Statistical Area.

‡“Urban” means a Standard Metropolitan Statistical Area.

§The schools are listed in descending order of the number of their graduates practicing in rural Appalachian counties.

¶Marshall's first class graduated in 1981.

the time period studied, 49% of the people lived in rural areas, 36% of the primary care physicians practiced in rural areas, and 31% of all physicians, regardless of specialty, practiced in rural areas.

In West Virginia, 65% of the population lived in rural areas, 62% of the primary care physicians practiced in rural areas, and 60% of the physicians, regardless of specialty, practiced in rural areas.

In all of Appalachia except West Virginia, 47% of the population lived in rural areas, 32% of the primary care physicians practiced in rural areas, and 28% of the physicians, regardless of specialty, practiced in rural areas.

The percentage of primary care physicians considered in this study who had begun to practice in rural counties of West Virginia (62% in rural counties) nearly matched the rural population distribution for this state (65% in rural counties). However, the comparable placement of primary care physicians in the rest of Appalachia (32% in rural counties) fell far below the rural population distribution (47% in rural counties).

Summary and Conclusions

Analyses of the health professions' ability to place primary care physicians in rural areas of Appalachia indicate that the University System of West Virginia, consisting of the West Virginia School of Osteopathic Medicine, Marshall University Medical School, and West Virginia University Medical School, was the most successful. Seventeen percent of the graduates (1978-1986) of this system provided primary care for rural Appalachia.

The West Virginia School of Osteopathic Medicine successfully retained 106 of its graduates practicing

in primary care in rural Appalachia with 77 of them throughout rural West Virginia. These results indicate that during the time period studied, the WVSOM was the nation's leading provider of primary care physicians practicing in rural regions of Appalachia and West Virginia.

The geographic distribution of primary care physicians throughout all of Appalachia indicates that 36% were practicing in rural and 64% in urban areas. When all graduates, including all specialties, are considered, 31% were in rural areas and 69% in urban areas.

The geographic distribution of primary care physicians throughout West Virginia indicates that 62% were practicing in rural areas and 38% in urban areas. When all graduates, including all specialties, are considered, 60% were in rural areas and 40% in urban areas.

These findings indicate that the concerns of medical educators and public health officials over the poor distribution of all physicians (31%) and especially primary care physicians (36%) in rural Appalachia are well founded. The distribution of West Virginia physicians indicates that the trend toward urban practice, as described for Appalachia, does not hold true for West Virginia's physician population. In West Virginia, 62% of those in primary care and 60% of all physicians were practicing in rural regions throughout the state. The percentage of primary care physicians practicing in rural counties of West Virginia nearly matched the rural population distribution for this state (65% in rural counties) during the time period studied. When West Virginia is excluded from the analyses, the distribution of primary care physicians in the rest of Appalachia (32% in rural counties) falls far below the rural population distribution

(47%).

These data support concerns that the physicians who are returning to practice in Appalachia are distributed disproportionately, more to urban rather than rural counties (with the exception of West Virginia).

These findings should be a source of deep concern that medical educators and public health and governmental agencies are failing in their efforts to train and attract physicians who will serve the rural populations of Appalachia. The authors hope that this study's findings will provide a point of reference in the struggle to resolve the numerous health care delivery problems of Appalachian communities.

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A Review of Studies Concerning Effects of Sleep Deprivation and Fatigue on Residents' Performance

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Abstract—Possible effects of sleep deprivation and fatigue on the performance and well-being of residents have received little scientific examination until recently. This article is a review of the studies on this topic published since 1970. All those studies that dealt with residents' moods and attitudes demonstrated deleterious effects of sleep deprivation and fatigue. The implications of this finding for patient care deserve exploration. Residents' acuity on performance tests requiring prolonged vigilance tended to deteriorate with acute sleep loss, while their performances on most brief psychomotor tests measuring manual dexterity, reaction times, and short-term recall were not adversely

affected. The data presently available suggest that sleep-deprived or fatigued house officers can compensate for sleep loss in crises or other novel situations. However, sleep-deprived residents may be more prone to errors on routine, repetitive tasks and tasks that require sustained vigilance, which form a substantial portion of residents' workload. The authors concur with the recommendation of the Executive Council of the Association of American Medical Colleges that the total working hours for residents should not exceed 80 hours per week averaged over four weeks. *Acad. Med.* 66(1991):687-693.

The death of a young woman under the care of residents in a New York City hospital in 1984 led to a grand jury investigation and national media coverage. The grand jury's determination that the residents' fatigue and lack of supervision might have contributed to the patient's death set in motion forces that have substantially altered the structure of physician training in the United States.^{1,2} In 1989 the New York State Hospital Review and Planning Council amended the state's hospital code to restrict the number of hours worked by resident physicians and to regulate supervision.³ At the same time, the Accreditation Council on Graduate Medical Education requested each of the 24 major specialties to develop individual accreditation rules for residents' working conditions. The specialty with the most residents, internal medicine, made the first and most radical change, implementing an 80-hour work week limit. Other specialties, such as general surgery, currently have no limit on working

hours. Failure to develop universal guidelines for residents' working conditions has caused a rift among member organizations of the Accreditation Council for Graduate Medical Education.⁴

The perpetuation of long hours in residency training has been criticized by some as a form of hazing or rite of passage,^{5,6} and defended by others as a necessary component of medical training.⁷ The American Medical Association's Center for Health Policy Research reported that in 1987, the average resident spent 79.2 hours per week performing residency-related duties. Interns average 85 hours per week for all specialties combined and over 100 hours per week in surgery specialties.⁸ Many hospitals' schedules are structured in such a way that residents' night call and long hours are an integral part of the way in which care is provided to patients. One reason this is of concern is that in today's legal climate, hospitals may be held accountable for unfavorable outcomes deemed by juries to have resulted from exhaustion on the part of the housestaff.

Despite the strong opinions expressed regarding the effects of long working hours and sleep deprivation on residents' performance, this subject has received relatively little scientific examination until recently. Asken and Raham provided a review of the relevant literature in 1983, and identified only six studies involving

physicians.⁹ More recently, national attention to residents' working conditions has resulted in a proliferation of articles on the topics. The present review was undertaken to assess the scientific evidence regarding the effects of sleep deprivation and fatigue on residents' performance and well-being.

Method

The present review identified experimental studies that measured the effects of sleep deprivation and fatigue on residents' performances, moods, attitudes, and interactions with patients. The following databases were searched from 1980 to the present: MEDLINE, *Psychological Abstracts*, *Biological Abstracts*, and *Psychological Information*. From these references, key studies prior to 1980 were identified. All studies since 1970 involving the effects of sleep deprivation and fatigue on physicians in training¹⁰⁻³⁶ are summarized in Table 1. The extensive literature on sleep physiology and sleep disruption in the nonphysician population was not comprehensively reviewed.

Findings

As shown in Table 1, many of the studies used more than one measurement instrument to evaluate residents' well-being and performance. However, for the sake of clarity in the

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Table 1
Post-1970 Studies of the Effects of Sleep Deprivation and Fatigue on Residents

Source	Persons Studied	Definition of Fatigue or Sleep Loss	Measurement Instruments	Comments
Friedman et al. 1971, ¹⁰ 1973 ¹¹	14 medicine interns	Rested: avg. 7.0 hr sleep Fatigued: avg. 1.8 hr sleep	20-min standardized EKG Mood adjective checklist Modified Jarvik questionnaire Psychiatric interviews Videotapes of surgery	Interns were on call every other night, and often two consecutive nights
Goldman et al. 1972 ¹²	Surgery residents, students, attendings	Rested: not defined Fatigued: < 2 hr sleep		Criteria for surgical performance not defined 33 operations were analyzed
Wilkinson et al. 1975 ¹³ Beatty et al. 1977 ¹⁴	6,500 house officers 6 anesthesia residents	Not defined Rested: regular sleep Fatigued: < 2 hr sleep	Questionnaire 50-minute monitoring task Neisser letter search Bradley grammatical reasoning	2,454 respondents Monitoring task designed to simulate key aspects of monitoring surgery
Christensen et al. 1977 ¹⁵	14 radiology residents	Rested: regular sleep Fatigued: worked 15 hr	25 standardized radiographs	Beeswax nodules imbedded in dogs' lungs used for radiographs
McManus et al. 1977 ¹⁶ Poulton et al. 1978 ¹⁷	134 junior house officers 30 junior doctors	Not defined Sleep debts of 0 to 7 hr at two times of the year	Questionnaire 3-min grammatical reasoning 3-min lab form	64 respondents Sleep debt as defined probably underestimated, true loss of sleep
Leighton and Livingston 1983 ¹⁸	12 junior doctors	Rested: regular sleep Fatigued: after call	PASAT Psychological questionnaire	Report was too brief to permit full evaluation of study
Ford and Wentz 1984 ¹⁹	27 interns	At 4 times during internship	Critical flicker fusion reaction time Profile of mood states	Subjects studied at 4 times during internship with interviews conducted during on-call, before acute sleep deprivation occurred
Harrah 1984 ²⁰	32 medicine and surgery interns	Rested: avg. 7.4 hr sleep Fatigued: avg. 3.3 hr sleep	Symbol digit modalities Trail-making test B Raven's standard progressive matrices Bradley grammatical reasoning Category accessing team Stroop color word test Raven's progressive matrices Trail making Nutrition questionnaire	Specialty played a role in determining performances of sleep-deprived residents
Hawkins et al. 1985 ²¹	68 residents	Rested: > 5 hr sleep Fatigued: < 5 hr measured at two times of the year		Quantity and quality of food consumed in previous 24 hr were positively correlated with performances on tests
Klose et al. 1985 ²²	14 anesthesia residents	Rested: 8 AM Monday Fatigued: after successive calls	Digit symbol Wisconsin card sort Purdue pegboard Stroop color word test	Subjects tested on 5 consecutive days, confounding effects of fatigue with learning effects

Table 1—Continued

Source	Persons Studied	Definition of Fatigue or Sleep Loss	Measurement Instruments	Comments
Narang and Laycock 1986 ²³	16 anesthesia residents	Rested: at 1400 Fatigued: at 2300 or 0200	Critical flicker fusion reaction time Choice reaction time	Residents tested at 1400, 1600, and 0200
Denisco et al. 1987 ²⁴	21 anesthesia residents	Rested: regular sleep Fatigued: after call	30-min simulated videotape	Subjects were to detect "significant changes in monitor-parameters," but were given no definition of "significant" change
Reznick and Folse 1987 ²⁵	21 surgery residents	Rested: > 5 hr sleep Fatigued: < 3 hr sleep	Factual recall 11-min lab forms Simulated suturing Purdue pegboard Manual dexterity	Only 12 subjects completed testing in both rested and fatigued states
Engel et al. 1978 ²⁶	7 medicine interns	Rested: avg. 7.3 hr sleep Fatigued: avg. 3.6 hr sleep	Actors as simulated outpatients Profile of mood stress	Clinical performances evaluated by checklist of interview content and notes
Hart et al. 1987 ²⁷	30 medicine interns	Rested: avg. 7.9 hr sleep Fatigued: avg. 2.7 hr sleep	Sternberg Short Memory PASAT Immediate story recall Delayed story recall Multiple-affect checklist Multiple affect Thinking efficiency	Long-term recall affected more than short-term recall after sleep loss
Bartle et al. 1988 ²⁸ Light et al. 1989 ²⁹	42 surgery residents	Rested: > 4 hr sleep Fatigued: < 4 hr sleep	Digit symbol Story memory Digit vigilance Trail making PASAT Raven's advanced matrices Purdue pegboard Profile of mood states	Differences between interns and more senior residents was noted in mood states and manual dexterity
Deaconson et al. 1988 ³⁰	26 surgery residents	Rested: > 4 hr sleep Fatigued: < 4 hr sleep	PASAT Trail making Grammatical reasoning Minnesota form board Purdue pegboard Subjective fatigue Subjective motivation	Cash incentive for performance Residents on every-other night call
Sharp et al. 1988 ³¹	7 interns	Rested: new residents Fatigued: mean sleep loss 2.5 hr	Wilkinson unprepared reaction time Serial search test Verbal reasoning Profile of mood states	Subjects studied the week prior to starting into residency, also studied sulfatoxymelatonin excretion
Bertram 1988 ³²	10 second-year residents	Number of hours worked	Records of patient encounters	ER shifts from 10 to 14 hr long
Storer et al. 1989 ³³	45 pediatrics residents	Rested: regular sleep Fatigued: after 24 hr and 36 hr	30-item test Endotracheal intubation Vein catheterization Artery catheterization	Subjects stayed awake voluntarily not in the course of clinical duties

Table 1—Continued

Source	Persons Studied	Definition of Fatigue or Sleep Loss	Measurement Instruments	Comments
Lewittes and Marshall 1989 ³⁴	2,600 residents	Not defined	Questionnaire	1,805 respondents
Orton and Gruzelier 1989 ³⁵	20 house officers	Rested: without call Fatigued: after call	Choice reaction time Vigilance reaction time Haptic sorting task Profile of mood states	Subjects studied after working 31 hours
Jacques et al. 1990 ³⁶	353 family practice residents	Not defined	4-hr in-training exam	Linear regression used to evaluate decline in test score with sleep

*The authors reviewed the findings of all post-1970 studies of the effects of sleep deprivation and fatigue in residents. The superscript number that identifies each study corresponds to the number assigned the reference citation for that study in the reference list presented elsewhere in this article.

following text, findings of these studies are grouped according to the nature of the measurement instrument.

Surveys of House Officers

There have been three published reports of house officers' opinions about the hours they work and the effects of long hours on patient care. Wilkinson and colleagues¹³ sent a questionnaire regarding sleep deprivation to 6,500 house officers in Great Britain. Of the 2,452 residents who responded, 37% reported that their hours of duty were always or often long enough to impair their ability to work with adequate efficiency. The respondents were invited to make open ended comments; 141 residents recounted actual errors caused by overwork and sleep deprivation. These findings were substantiated by McManus and colleagues,¹⁶ who surveyed graduates of the University of Birmingham. In this survey, 39% of the respondents indicated that sleep loss commonly affected their working efficiency, and 28% indicated that sleep loss affected their relationships with patients.

In a more recent study, Lewittes and Marshall³⁴ surveyed 1,806 house officers in Ontario, Canada. In this study, 70% of the respondents indicated that they were often bothered that the amount of work interfered with how well the work was done. Six percent of all the respondents and 10% of the interns indicated that they were often bothered that the quality

of patient care was affected by fatigue.

Studies of Mood, Affect, or Attitude

Ten of the studies reviewed for this report used standardized mood scales or other measures to assess the effects of sleep deprivation on residents' moods and attitudes. Friedman and colleagues^{10,11} carried out the most widely quoted study. In this study using a modified Jarvic questionnaire, sleep-deprived interns reported more sadness and less egotism and social affection on a mood questionnaire, and significantly more psychophysiologic abnormalities, than did rested residents. During short interviews following standardized tests, sleep-deprived interns reported such psychological problems as difficulty in thinking, depression, irritability, depersonalization, inappropriate affect, and recent memory deficits.

In a longitudinal study, Ford and Wentz¹⁹ evaluated interns at four times during their internship year. Four of the 27 interns had at least one episode of major depression during the year by standard criteria, and an additional 11 claimed to have experienced a clinical depression. Anger, fatigue, and overall dysphoria increased as the year progressed and were found to be negatively correlated with the amount of sleep obtained in the preceding week. Sharp and colleagues³¹ also found that interns' moods, as assessed by the Profile of Mood States,

were significantly worse after six months of residency due to increases in their anger, tension, confusion, depression, and fatigue.

Six studies^{28-30,34} used the profile of mood states or other self-reported data to assess resident affect or motivation after one night's sleep loss. In each study, a deterioration occurred after sleep loss, with residents reporting a greater decrease in thinking efficiency, a greater mood disturbance, more depression, more fatigue, more anxiety, and less motivation than did the control group.

Psychomotor and Neuropsychological Tests

Because of the difficulties in trying to measure actual clinical performances, many studies of sleep deprivation in residents have relied on neuropsychological tests as proxy measure.^{14,17-23,25,27,28,30,31,35} The validity of this practice is not known. Over 20 standardized and nonstandardized psychomotor and neuropsychological tests were used in the studies reviewed. The majority of these tests were less than three minutes in duration. The results of residents' performances on short psychomotor tests after the residents had been on call the preceding night are summarized in Table 2. Direct comparison of the results of these studies is difficult because of the wide variety of experimental conditions used in the tests. The only clear trend that is evident is

that in short-duration tests manual dexterity, reaction times, and recall tasks did not seem to deteriorate in most studies after one night's sleep loss.

Two studies compared residents' performances at the beginning of the year and later in the year. Sharp and colleagues³¹ found that there was a decrease in the Wilkinson unprepared reaction time but no change in a serial search test or a verbal reasoning test. Ford and Wentz¹⁹ tested residents the evening they were on-call at four different times during the year. They actually found that performances improved with decreased sleep in the preceding week and that increased performance was positively correlated with anger as measured by the Profile of Mood States.

Simulated and Actual Performances

A total of 11 studies used actual or simulated clinical situations to evaluate clinical performance. Poulton and colleagues¹⁷ used a three-minute laboratory form, and Reznick and Folse²⁵ used an 11-minute laboratory form and a simulated suturing technique. For these short tasks there were no significant differences between the sleep-deprived and control groups of residents. Storer and colleagues³³ evaluated residents' procedural skills such as endotracheal intubation, vein catheterization, and artery catheterization, and used a written test consisting of 30 board examination questions. There was a slight increase in the time the residents required to catheterize umbilical arteries in the study but no difference in the other measures of performance between the sleep-deprived and the rested residents. Christianson and colleagues¹⁵ found no difference in the accuracies in identifying simulated pulmonary nodules on standardized chest films between residents who were allowed to review the films in the morning and residents who reviewed the films after they had worked 15 consecutive hours. Similarly, in a study by Engel and colleagues, there was no difference between the clinical performances of rested and sleep-

Table 2
Studies of Residents' Performances on Short Psychomotor Tests after Residents Had Been on-call*

Psychomotor Test	Studies Showing a Decrease in Performance	Studies Showing No Decrease in Performance
Manual dexterity task	—	25
Choice reaction time	—	23, 35
Digit symbol	—	20, 22, 28
Minnesota form board	—	28
Neisser letter search	—	14
Immediate recall	—	27, 28
Wisconsin card sort	—	22
Category assessing time	—	20
Purdue pegboard	29†	22, 25, 30
Bradley grammatical reasoning	14	20, 30
Paced auditory serial addition	18	27, 28, 30
Raven's progressive matrices	21	20, 28
Trail-making test	20, 21	28, 30
Sternberg short memory	27	—
Critical flicker fusion	23	—
Stroop color word test	20, 22	—
Haptic sorting task	35	—
Vigilance reaction time	34	—
Delayed story recall	27	—

*The authors reviewed the findings of all post-1970 studies on the effects of sleep deprivation and fatigue in residents. This table indicates the findings from all studies of residents' performances on short psychomotor tests after the residents had been on-call the previous night. The studies are listed by their numbers in the reference list of this article.

†Only the first-year residents showed a decrease.

deprived residents who evaluated actors trained to pose as patients seeking medical care for common outpatient problems.

Four studies that evaluated tasks requiring sustained vigilance or concentration did show significant differences between rested and sleep-deprived residents. Friedman and colleagues' study¹⁰ found that sleep-deprived interns made nearly twice as many errors as did rested interns when reading a standardized 20-minute electrocardiogram strip. Beatty and colleagues¹⁴ used a 50-minute simulated monitoring task and Denisco and colleagues²⁴ used a 30-minute simulated videotape to evaluate the vigilance of anesthesiologists under rested and under sleep-deprived conditions. Both studies showed decreases in performance after a night on call. Jacques and colleagues³⁶ evaluated the effects of sleep loss on cognitive function using a standardized four-hour in-training examination.

Residents at all levels of training showed significant deterioration with sleep loss in their test scores on the four-hour exam.

Only two studies have attempted to evaluate changes in residents' performances with fatigue or sleep loss in actual clinical situations. Goldman and colleagues¹² monitored surgery personnel during 33 operative procedures using a closed-circuit television system. Residents with less than two hours' sleep the previous night performed in a way that was considered "inferior" when compared with the performances of the more rested surgeons. Operative inefficiency and indecision with poorly planned maneuvers exceeded 30% of the operating time. Bertram³² examined the records of patient encounters of second-year residents during a month of work in an emergency room department. For two common diagnoses, there were decreases in the comprehensiveness of the history and physical examina-

tions recorded in the medical records as the numbers of hours worked by the residents and the numbers of patients they saw increased.

Discussion

An understanding of the effects of sleep loss and fatigue on residents' performances may be put in perspective by considering some of the literature on sleep deprivation in non-physician populations. It appears from the large psychological literature on sleep deprivation that the primary effects of acute sleep deprivation center on impairment of brain function. In healthy non-physicians, behavioral performance and psychological performance measurably decline after one night's sleep loss, and decline further as sleep loss continues. Performance apparently can be improved substantially in sleep-deprived persons by increasing mental effort, particularly if the task is interesting, if it involves perceptual motor skills, or if incentives are provided. However, performances on tasks that are prolonged, dull, or repetitive may be very sensitive to sleep deprivation.³⁷ Many of the tests used in the studies of residents were of short duration, involved perceptual motor skills, and may not have been sensitive enough to measure true changes in performance. The relevance of performances on such psychomotor tasks to performance of residents' actual clinical work is open to debate.

The effects of chronic sleep deprivation have been less extensively studied than those of acute sleep deprivation. Health non-physician volunteers apparently can tolerate a chronic reduction of up to two and one-half hours sleep per night without significant performance deficits; however, subjective fatigue and a decrease in effort do occur with chronic sleep deprivation.³⁸⁻⁴⁰ In most of the studies involving residents, either all were chronically sleep-deprived or their long-term sleep status was unknown. Several studies of surgery residents that failed to show deterioration of performance on short psychomotor tests after acute sleep deprivation

involved residents with schedules of every-other-night call that involved chronic sleep deprivation in excess of that previously studied in non-physician populations. Thus, these studies of surgery residents may have been comparing two or more equally exhausted populations.

Interpretation and comparison of the results of the reviewed studies of fatigue and sleep deprivation in residents are difficult because of the inconsistent definitions of sleep loss, the lack of differentiation between acute and chronic sleep deprivation, and the wide variety of tests and experimental conditions used in the individual studies. In all but two studies, the residents were aware that they were being tested, which may have altered their motivations. In addition, most of the studies used relatively small numbers of residents and may not have been powerful enough to identify small but clinically significant changes in performance.

Despite these limitations, some trends are apparent. The most obvious finding is that mood states clearly change with sleep loss. Hostility and anger were greater in residents after one night's sleep loss and in residents at midyear compared with residents at the start of training. Anger may actually improve performance on short psychomotor tasks. This could mask some of the detrimental effects of sleep deprivation found in other studies where no deterioration of performance was seen on psychomotor tests after sleep deprivation. Mizrahi⁴¹ has addressed the enormous implications of housestaff hostility and anger for quality of patient care in doctor-patient relationships. This topic deserves further systematic study. Symptoms of depression were also commonly reported with acute and chronic sleep deprivation. Although not all the residents reporting depression symptoms meet the criteria for the diagnosis of depression, some residents are clearly at risk for such unfavorable outcomes as leaving the residency or attempting suicide.⁴²

The findings of the studies re-

viewed were less conclusive with respect to the effects of fatigue and sleep deprivation on measures of performance. Although there was some inconsistency of results between the studies, it appears that performances of short tasks that measure manual dexterity, reaction time, and short-term memory are reasonably unchanged after sleep loss. Some procedural skills may require more time to perform. Clinical tasks requiring sustained vigilance or concentration are the most sensitive to sleep loss and fatigue.

It seems reasonable to conclude that residents can compensate for acute sleep deprivation on short tasks when they know they are being tested, but not on tasks of longer duration requiring vigilance. They may be able to perform some tasks as accurately but at a slower pace when acutely sleep-deprived. These conclusions imply that in the world of the hospitals in which they work, acutely sleep-deprived house officers may remain effective, if somewhat less efficient, in crises and other novel situations. Residents may be more prone to errors on the routine, repetitive tasks that constitute much of their work.

Recommendations

Asken and Raham⁹ in their review of literature on sleep deprivation in residents, suggested that "at a minimum, a medical education experience should be able to demonstrate that it can live up to the dictum 'above all do no harm.'" The accumulated evidence of studies performed of the past 30 years reviewed in this paper suggests that the traditional system of 100-hour work weeks and 36-hour days may do harm. Clearly, residents' moods, affects, and attitudes are altered unfavorably. Although the effects of sleep deprivation on actual clinical care have yet to be directly measured in large, well-controlled studies, the evidence collected to date suggests that tasks requiring vigilance and prolonged concentration are adversely affected by the sleep losses imposed by residents' work

schedules.

In the United States, residents' working conditions are slowly changing. In the absence of better information on the effects of sleep deprivation and fatigue, it seems reasonable to adopt the recommendations offered by the Executive Council of the Association of American Medical Colleges, which state that the total working hours should not exceed 80 hours per week when averaged over four weeks.⁴³ Government agencies should recognize the added costs imposed by reform and modify direct and indirect education costs appropriately.

In New Zealand, residents' work hours have been limited since 1985. Problems and solutions encountered in New Zealand and in New York's current effort to reduce residents' hours should be closely examined.

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SHORT PAPERS

Residency Directors' Assessments of Which Selection Criteria Best Predict the Performances of Foreign-born Foreign Medical Graduates during Internal Medicine Residencies

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Abstract—In the summer of 1990, 102 directors of internal medicine residency programs from nine areas of the country with the largest numbers of foreign-born foreign medical graduates (FFMGs) were surveyed by mail to determine what criteria used to select FFMGs for residency positions best predicted performance. The directors felt that the most important predictors were performance on the Foreign Medical Graduate Examination in the Medical Sciences or the National Board of Medical Examiners examinations; performance during the interview; and

postgraduate clinical experience in the United States. Recent graduation from medical school was felt to be a better predictor than postgraduate clinical experience in a foreign country. Seventy-three percent of the directors found letters of recommendation from a foreign country to be useless. The author suggests the results of this study may be useful to residency programs in evaluating FFMG applicants and to FFMGs in assessing their own credentials. *Acad Med.* 66(1991):699-701.

While studies have evaluated predictors of residency performance for U.S. graduates, none has done so for foreign-born foreign medical graduates (FFMGs). The purpose of this study was to gather and disseminate information from directors of programs with large numbers of FFMGs regarding the selection criteria that they have found to be most useful in predicting the performances of FFMGs during internal medicine residencies.

Method

Using the National Resident Matching Program data books for the years 1987, 1988, and 1989, the author identified the states that had the larg-

est numbers of FFMGs matched to internal medicine residency positions. The top nine states were New York, Illinois, New Jersey, Maryland, Michigan, Ohio, Pennsylvania, Missouri, and the District of Columbia. These nine areas matched more than 81% of all FFMGs matched to internal medicine in each of the three match years. Using the 1989-1990 Directory of Residency Training Programs,¹ the author mailed a questionnaire to every internal medicine residency program director in these areas. Two hundred and eighteen questionnaires were mailed in July and August 1990.

Program directors were asked to rate (based on their observations) the importances of 22 selection criteria as predictors of FFMGs' performances during residency. The scale for each criterion was 1 to 5, where 1 was "not a predictor" and 5 was "a very important predictor." The directors were also asked how much they agreed (or disagreed) with four statements regarding some of the predictors. The scale for each statement was 1 to 5, where 1 was "strongly disagree," 5, "strongly agree," and 3, "neither agree nor disagree."

Results

One hundred and seventy-one directors (78%) responded. Sixty-nine of these responding directors (40%) indicated that they had had, on the average, fewer than three FFMGs in each of their first-year postgraduate classes over the preceding three years. They were not asked to complete the questionnaire. One hundred and two respondents (60%) had had three or more FFMGs per class, and all of them completed the questionnaire. Of these 102 directors, 50 had had averages of three to eight FFMGs per class, and 52 had had averages of more than eight FFMGs per class.

Table 1 shows the ratings given by the directors to the 22 selection criteria. The selection criteria rated most highly were performance on the Foreign Medical Graduate Examination in the Medical Sciences (FMGEMS) or the National Board of Medical Examiners (NBME) examinations; performance during the interview; and postgraduate clinical experience in the United States. Determining fluency in the English language was rated as the most impor-

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Table 1
Ratings by Internal Medicine Residency Directors of Predictors of Performance during Residency of Foreign-born Foreign Medical Graduates (FFMGs), 1990*

Criterion	Program Ratings, by Program Size					
	Overall (n = 102)		3-8 FFMGs per Class (n = 50)		More than 8 FFMGs per Class (n = 52)	
	Mean	SD	Mean	SD	Mean	SD
1. Score on clinical science component of FMGEMS or NBME II	4.34	0.73	4.37	0.73	4.31	0.73
2. Fluency in English as determined during interview†	4.30	0.74	4.50	0.76	4.12	0.68
3. Number of attempts on clinical science component of FMGEMS or NBME II	4.30	0.69	4.35	0.75	4.25	0.63
4. Postgraduate clinical experience in the United States	4.20	0.93	4.22	0.91	4.17	0.96
5. Number of attempts on basic science component of FMGEMS or NBME I	4.10	0.86	4.19	0.87	4.02	0.85
6. Score on basic science component of FMGEMS or NBME I	4.07	0.95	4.21	0.93	3.94	0.96
7. Interview performance on nonmedical issues (e.g., personality)	4.02	0.84	4.04	0.86	4.00	0.82
8. Medical school (if known to program director)	3.98	0.95	4.10	0.77	3.86	1.10
9. Year of graduation (recent graduates performing better)	3.84	1.02	3.76	0.98	3.92	1.08
10. Performance during interview on medical questions (e.g., quiz, case presentation)	3.65	1.08	3.43	1.13	3.84	1.01
11. Country of medical education	3.64	1.09	3.70	0.97	3.58	1.19
12. Score on Federation Licensing Examination (FLEX)	3.54	1.11	3.73	1.06	3.35	1.15
13. Rank order in medical school class	3.35	1.16	3.24	1.19	3.38	1.14
14. Age (younger graduates performing better irrespective of graduation date)	3.33	1.02	3.38	0.99	3.27	1.06
15. Letters of recommendation from the United States‡	3.27	1.07	3.52	0.99	3.04	1.10
16. Postgraduate clinical experience in foreign country	3.12	1.12	2.98	1.06	3.25	1.17
17. Passing the FLEX before applying for residency‡	3.12	1.16	3.38	1.09	2.87	1.19
18. Duration of living in the United States	3.03	0.98	3.12	1.01	2.94	0.95
19. Medical school grades (transcript)	2.94	1.08	2.94	0.92	2.94	1.21
20. Nonclinical graduate work in the United States (e.g., basic science graduate studies, research)	2.74	1.04	2.74	1.05	2.74	1.05
21. Dean's letter	2.32	0.96	2.39	1.00	2.25	0.93
22. Other letters of recommendation from foreign country	1.93	0.94	1.96	1.01	1.90	0.88

* Those program directors from the nine areas of the country with the largest numbers of FFMGs (NY, IL, NJ, MD, MI, OH, PA, MO, and DC) who had, on the average, at least three FFMGs per class over the three years preceding the summer of 1990 were asked, in a mailed questionnaire, to rate the importances of 22 criteria on a scale of from 1 to 5, where 1 indicated "not a predictor," and 5, "a very important predictor."

† Statistically significant difference in ratings between the two groups, $p < .01$ by Student's *t*-test.

‡ Statistically significant difference in ratings between the two groups, $p < .05$ by Student's *t*-test.

tant function of the interview; second was assessment of personality; last was assessment of medical knowledge.

Replies concerning how much the directors agreed or disagreed with the four statements were distributed as follows: (1) Seventy-three percent of the directors agreed that letters of recommendation from foreign countries were useless and relied on letters from the United States. Seven percent disagreed and 20% were neutral. (2) Sixty percent agreed that medical school transcripts and class ranks of FFMGs were useless and relied on examination scores. Twenty-one percent disagreed and 19% were neutral. (3) Forty-four percent agreed that

FFMGs who had been away from clinical medicine for more than one year performed poorly. Twenty-five percent disagreed and 31% were neutral. (4) Twenty-seven percent agreed that FFMGs straight out of medical school performed better than did those who had done clinical work in a foreign country. Thirty-three percent disagreed and 40% were neutral.

Discussion

Some of the selection criteria identified in this survey receive additional support from the literature. For example, Gunzburger and colleagues² studied 40 measures of premedical and medical school performance and

found that only NBME Part II examination scores and clerkship grades correlated with first-year residency performance. Others³ have found performance during internal medicine clerkship and the interview to be the most important variables used by internal medicine program directors in selecting residents. Jolly and colleagues⁴ found that the performances of foreign medical graduates in a clinical skills examination correlated most strongly with scores on a knowledge-based examination and scores on an English-language examination. Conn and Cody⁵ found correlation between foreign medical graduates' scores on the FMGEMS and performances on a clinical skills examination.

Interestingly, they were unable to show a correlation between U.S. clerkship experience and FFMGs' performances on that clinical skills examination. It is likely that the program directors in the present study used not only the applicants' having had U.S. clinical experience but also the applicants' performances during such experiences as a selection criterion.

This survey's findings with respect to recency of graduation deserve further discussion. The author's interpretation of the responses is that the majority of program directors found a short, but not a prolonged, duration of postgraduate clinical experience in a foreign country beneficial. The lower rating for clinical experience in a foreign country compared with such experience in the United States may be partly explained by the nature of the experience (in many foreign countries, clinical experience is largely limited to infectious, parasitic, and nutritional disorders that are of low prevalence in the United States) and partly by the quality of continued

medical education (which is poor to nonexistent in many countries). It is interesting to note that, in previous studies, neither year of graduation⁵ nor clinical experience of any kind⁴ was found to correlate with performance on a clinical skills examination for foreign medical graduates.

Letters of recommendation are among the most important factors used by programs in selecting residents from graduates of U.S. medical schools.³ In contrast, letters of recommendation from a foreign country, including deans' letters, received the lowest ratings in our survey. Only 7% of the program directors disagreed with the statement that such letters are useless. In view of this study's results, it seems reasonable to drop foreign letters of recommendation from the application requirements of FFMGs.

The findings of this survey should provide useful guidelines to programs selecting FFMGs for residency positions and useful information to FFMGs for assessing their own credentials.

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